REPORT

OF THE

COMMISSIONER OF AGRICULTURE

FOR

THE YEAR 1883.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1883.

Joint resolution for the printing of the Agricultural Report for the year eighteen hundred and eighty three.

Resolved by the Senate and House of Representatives of the United States of America in Congress assembled, That there be printed three hundred thousand copies of the Annual Report of the Commissioner of Agriculture for the year eighteen hundred and eighty-three; two hundred and fourteen thousand copies for the use of members of the House of Representatives, fifty-six thousand for the use of members of the Senate, and thirty thousand copies for the use of the Department of Agriculture: *Provided,* That the annual report of the Commissioner of Agriculture, to be printed and bound for general distribution, shall not exceed five hundred octavo pages, and the type shall be same as that heretofore used, and the sum of two hundred and twenty thousand dollars or so much thereof as may be necessary, is hereby appropriated to defray the cost of publication.

Approved, March 3, 1883.

REPORT

OF

THE COMMISSIONER OF AGRICULTURE.

DEPARTMENT OF AGRICULTURE,
Washington, D. C., November 10, 1883.

To the PRESIDENT:

I respectfully submit a statement of the work done in the Department of Agriculture during the year 1883.

I have thought it advisable to continue the policy laid down early in my service as Commissioner, of establishing as intimate relations as possible between the Department and the associations and institutions of the country which are devoted to the development and improvement of the art of agriculture, and of calling around the Department those whose knowledge and influence have given them especial authority in the various sections of the country. The beneficial effects of this course are already manifest. To every call of the Department for information and advice, the colleges and societies have responded promptly and liberally. Representatives of many of them assembled at the Department in January last, and presented a large amount of valuable information upon the practical questions of agriculture, and the various methods of imparting agricultural instruction, and of improving the social condition of the American farmers,—a carefully prepared and elaborate report of which has been issued by the Department. The work of obtaining reliable and useful information upon the various matters provided for by appropriations has been submitted, as far as practicable, to competent agents, who have furnished from actual observation and from extensive correspondence a vast amount of interesting and useful facts, from which it is believed important conclusions may ultimately be drawn. Investigations conducted in this manner concerning the cultivation and use of sugar-producing plants, and into the condition, increase, and preservation of our forests, have given most satisfactory results, and have brought the divisions devoted to these matters into most immediate connection with those who are actually engaged in these branches of industry. The employment of a carefully selected corps of agents and correspondents in the States and Territories, for the collection of statistical returns and statements in relation to the condition of crops, the animal industry,

rates of transportation, the markets, the products of the dairy, both at home and abroad, has given the Statistical Division of the Department, under its present experienced and efficient head, a reputation which is highly esteemed by those who understand the value of this information, and is accepted as sound and reliable by producers and consumers in our own country and by the best authorities in Europe. By this policy I have been enabled to secure most valuable reports of the exhibition of animals at Hamburg, and of the deliberations of the Veterinary Congress at Amsterdam, which will be submitted to Congress at an early day, and will form an important part of the investigations now being made into the condition of our animal industry and the subject of contagious diseases. In establishing this mode of rendering the Department as efficient and useful as possible, I have considered that its service is largely co-operative, and that it should constitute a receptacle into which all valuable information can be gathered and from which it can be distributed for the benefit of the agricultural community. The following condensed statements of the work performed by the various divisions of the Department will give the work of the Department in detail.

DIVISION OF GARDENS AND GROUNDS.

The distribution of plants propagated in the glass houses and grounds of the Department has, as usual, been quite extensive, considering the amount of space now available for this purpose. The grounds available for cultural purposes are yearly becoming more limited on account of the extension of buildings necessary for the use of the Department. With a view to increase the facilities of house propagation, a new greenhouse has just been erected. This structure is one hundred and fifty feet in length and twenty-four feet in width, built of the best materials, and specially arranged for the purposes for which it is to be employed. Attached to it are hot-beds comprising eighteen hundred square feet of surface, for the accommodation of young plants. The whole is effectually heated by steam, on a somewhat new plan, and it is found to be admirably adapted for the maintenance of a high degree of artificial temperature. The Japan persimmon, which has been extensively distributed by this Department, is proving to be a valuable addition to our list of fruits. The range of climate to which it may be adapted has not yet been fully ascertained, but large fruits have been ripened in this District, also in Southern New Jersey. The appropriation for continuing the culture of the tea-plant having been exhausted, a large quantity of surplus plants have been distributed. The plantation set out is sufficiently extensive for all experimental purposes, if means are provided for its continuance. To those familiar with this culture it is not expected that much can be proven to show that it can be commercially profitable. The climatic conditions are not favorable for it. The want of a proper amount of rainfall during summer is fatal to its extensive production for market, although it can be produced as

a domestic article, where profit is no object, over a large territory; and to this end thousands of plants are yearly distributed in districts where the winters are not severe enough to destroy the plant. The demand for orange plants, and others of what are designated as semi-tropical, is never failing. To supply this demand a new importation of the Citrus family has been secured. These will first be tested here before they are propagated to any extent, as has been done heretofore with fruits of this kind. The best oranges now raised in California are produced from the progeny of plants originally imported by this Department from Brazil, and subsequently disseminated in that and other States. An erroneous opinion prevails in regard to the objects of the distributions. Letters are constantly received inclosing the most extensive requirements for trees and plants of all kinds. No single plant establishment in the world could supply these orders, and many articles are called for which can be of no value to those requesting them, even could they be procured. It is the constant aim of the Department to introduce everything which indicates the possession of even the slightest possible value as compared with present productions, and it is on the alert that nothing of prospective value be overlooked.

BOTANICAL DIVISION.

During the year past numerous and important additions have been made both to the herbarium and botanical library. A number of zealous botanical collectors have been engaged in exploring the vegetation of the new and undeveloped portions of our country, with the result of increasing our knowledge of the flora of those regions and bringing to light many new and interesting species. These specimens, many of which we have secured, include representations of trees, shrubs, herbs, grasses, and all kinds of vegetation. A careful study of our native grasses, with reference to a determination of such as give promise of greater utility for meadows and grazing purposes, has been prosecuted. To aid in this work I have endeavored to encourage intelligent observations, by practical farmers and cultivators, of the various grasses of their respective localities, together with experiments in the cultivation of promising species. I have also continued and brought to a close the series of articles upon grasses for the Annual Report. During the year, this division has sent several large boxes and packages to foreign countries, to London, Paris, St. Petersburg, and to Austria. It has also continued its distributions to agricultural colleges and institutions of learning in this country as follows: To the University of the Pacific, San José, Cal.; to the Agricultural and Mechanical College of Texas, at College Station; to the University of North Carolina, Chapel Hill; to the Industrial University of Arkansas, Fayetteville; to the University of Minnesota, Minneapolis; to the Colorado Agricultural College, Fort Collins; to several other public and private institutions of learning, and to scientific investigators and correspondents. Some additions

have been made to the museum of the Department, and it is constantly visited by thousands of citizens and strangers, who are always pleased and instructed by the large collection of objects connected more or less intimately with the subjects of agriculture and general industry. The botanical library is now quite extensive, embracing about six hundred volumes of standard works of reference, both foreign and domestic, and furnishes an excellent opportunity for consultation by professors, teachers, and specialists in this line of research.

One of the greatest wants of agriculture in some parts of the country is the need of suitable grasses for hay and pasturage. Here is a field for practical and extended observation by the botanist, which, in view of its importance, would warrant the outlay of thousands of dollars. Much good has been accomplished by the inquiries which have been made in this matter through correspondence and the transmission of specimens to the office. But much more could be accomplished by field observations. Wide examination should be had of the range and habits of the native grasses of the desert or arid regions, in order to utilize the best and most promising for agricultural purposes. The same observation is needed as to the adaptation of foreign grasses and forage plants to the climate and soil of this country, or particular portions of it. The information thus obtained should be extensively spread before farmers, agriculturists, and stock-raisers, and they should be encouraged and assisted in making experiments with such new varieties as give promise of benefit. In view of the magnitude of the interests involved, it would be advantageous and proper that the botanist should investigate and study this question in the field for several months of the year.

There is another consideration calling for field-work; there are certain plants, trees, &c., which are rare and confined to very restricted areas, sometimes in remote places out of the range of ordinary botanical collectors, of which there is no representation in the herbarium, and to obtain specimens of which it is almost indispensable that the botanist should look for them in the field. By this means the herbarium will sooner reach its proper purpose of being an exponent of *all* the vegetable productions of the country, with the characters and habits of which the Botanical Division should have the means of an acquaintance.

MICROSCOPIC DIVISION.

The work of the Microscopic Division for the past year has consisted chiefly in making investigations of parasitic fungi which cause the blight of plants, fruits, and cereals. Owing to the unusual character of atmospheric conditions throughout the United States during the past season, fruit trees, grapevines, cereals, and plants generally have suffered seriously, in some instances from severe drought, and in other cases from excessive rains. In some localities fungoid diseases have appeared where they had not been hitherto observed, while in others they have materially increased. The Department is in receipt of many

letters from agriculturists, fruit-growers, and others with regard to plant diseases generally caused by cryptogamic fungi, directly or indirectly. Several varieties of grapevines in cultivated orchards have been injuriously affected both by drought and excessive rain. Apple and peach orchards have also suffered from the same cause. The object of these microscopical investigations is to discover to what class of pernicious natural influences, produced under unfavorable atmospheric conditions, may be attributed the destruction of crops, and to discover what remedies may be profitably employed as correctives in each individual case. Other important investigations have been made by the microscopist relating to the discovery of new parasitic diseases, accounts of which will be submitted in future reports.

CHEMICAL DIVISION.

The principal work of this division the past year has been an examination of American cereals, being a continuation of work done in previous years, and an introduction to an extended investigation of this subject which it is proposed to carry on. The results already obtained have been published in a special report of the Department, and are of interest as showing the effect of environment, and especially of soil and climate, upon the composition of the grain. A study of the milling products of wheat will soon be in progress for the purpose of comparing the value of different wheats as flour producers, and determining the relative effect of different processes of milling upon the composition and nutritive value of the products. An examination of flours of as different origin as possible will be made, with the idea of showing where the best may be obtained, and how important it is for economical reasons that the best should be used. From the interest which has already been shown by the farmers and millers of the country, it is believed that the results will be of great importance both to them and to the consumer. The other work of the division consisted of the analyses of several grasses at different stages of development as a conclusion of work of a previous year, the analyses of a large number of the fruits and vegetables of our markets, and of several of the commoner ones at intervals in their growth. Several minor investigations, of which it is unnecessary to speak here, were carried on, and a large number of examinations and analyses of waters, marls, and other substances of agricultural interest were made. The results will appear in the Annual Report of the Department for 1883.

INVESTIGATION OF SORGHUM.

The investigation of the sorghum plant during the past year has been directed in the following lines:

1. The manufacture of sugar from the canes and determination of the yield per ton.

2. Experiments in extracting the juice from the canes by diffusion.

These were highly successful. The increased yield of this method over milling has been found to be between 25 and 30 per cent.

3. Experiments in defecation. The most important of these has been the method (used in Europe for sugar beets) of treating the juice with an excess of lime and afterwards removing this excess by carbonic acid. The results of the experiments have been, in the main, satisfactory. The results have been much better with mill juice, than with juice obtained by diffusion. This process promises to be of so great value to the sugar interest that it is highly important the experiments be continued on a larger scale next year.

4. Separation of sucrose from molasses by barium, lime, and strontium. This work has not yet been done, but is an essential part of the plan of the year's work. It will be undertaken at once, when the grinding season of the cane is over.

AMERICAN BUTTERS AND THEIR ADULTERATIONS.

No thorough investigation of the butters of the country has ever been made, and this investigation was undertaken by the division in order to aid the dairy interest in establishing a standard of good butter and to protect the consumers against fraud. About forty butters, from differents parts of the country, have been examined up to the present time. Of butter adulterants, examinations have been made of lard, tallow, oleomargarine, and cotton-seed oil. The following are the points to which the investigation is chiefly directed:

1. To determine the average quantity of soluble fat-acid (butyric acid).

2. To determine the average amount of water and salt in the butters of commerce.

3. To determine the influence of the different breeds of cattle on the composition of the butter.

4. To determine the influence of different kinds of food and climatic conditions on the quality of the butter.

5. To determine the extent and kind of adulteration and the best method of detecting it.

ENTOMOLOGICAL DIVISION.

The Entomologist has been active in improving the efficiency of this division and in carrying on important field investigations and experiments. The outside or field work has included, among other things, continued study of the insects affecting the orange tree in Florida, and the remedies discovered and recommended are being very generally used and appreciated. Observations on the cotton-worm have been continued in Alabama and Texas, and further experiments with machinery devised for its destruction have been made. Exploration of the breeding grounds of the Rocky Mountain locust, or destructive grasshopper

of the West, have warranted Professor Riley in concluding that the prospect of immunity from its ravages in 1884 is as bright as it has been at any time since 1878. As the southern and western portions of the country have claimed most of the attention of the division for some years past, it has lately given more attention to those insects which injuriously affect northern crops.

The serious ravages of grasshoppers in the Merrimac Valley, New Hampshire, have received careful attention and with the most satisfactory results, as shown by the correspondence of the Department. The death of spruce and larch forests in New England has also been investigated, and the causes satisfactorily ascertained. A final solution of the problem was very desirable, as many conflicting views were held. The insects injurious to the hop-vine and to the cranberry have also been specially studied, while a series of experiments made with a view of protecting fruit and shade trees from leaf-feeding species have been fruitful of useful results. In the investigations that are being made of those insects which injure the cotton plant, the orange and the sugar-cane, the Entomologist has felt the need of more accurate information than was on record of such as affect those crops in Brazil, and which are common to that country and the United States. Mr. John C. Brauner and Mr. Albert Koebele were, therefore, commissioned to proceed to Brazil with instructions to study these various subjects. Their studies have resulted in much important information. Though the phyloxera is less injurious to our American vines than to those of Europe, yet everything pertaining to it has an especial interest. It gives me pleasure to state that the Entomologist has during the year made some interesting discoveries in its life habits, and that experiments with petroleum emulsions, which have not hitherto been used against it, indicate that such emulsions afford one of the cheapest and most effective remedies yet discovered. A large number of silk-worm eggs have been distributed, and liberal quantities of pyrethrum seed have been supplied to correspondents. Reports show encouraging results from the efforts of the Department to introduce and establish the cultivation of this valuable plant. The report of the Entomologist treats of these and other subjects, and also contains the results of late work on the worms that so seriously affect the cabbage crop. The office work and the correspondence of the division increase with the growing interest which our farmers manifest in the subject of economic entomology.

DIVISION OF STATISTICS.

This division has never done better work than in the past year. It has advanced its standing for accuracy and breadth, in this and in foreign countries. Its aim is in direct contrast with the prevalent haste and superficiality of the day, towards completeness and fullness of statement, a true parallelism in comparison, and legitimacy in deduc-

tion. In agricultural statistics the effort has been unremitted to obtain the best results, by methods new and old, not only in crop production, its changing areas and fluctuating yields, but in the progress of enlightened agriculture, in science applied to rural arts, in the distribution of the products of the earth, the cost of their transportation, the commercial aspects of such distribution, and the resulting interdependence and correlation of all industries. The division has had the co-operation of State officials and State boards of agriculture, by which unity of results between the various official systems of crop statistics has been practically attained, to the advantage of all, and the promotion of public confidence in the substantial verity of reported results. Where no official State organization has been in existence, the statistical agent of the Department has organized a system of correspondence, to corroborate and supplement the work of the regular Department corps of county correspondents. The voluntary work of all these local assistants is thankfully acknowledged.

During the past year the division has extended its work to Europe, with an office in London, its agent being also deputy consul-general at that point, with good results as a beginning of a difficult work and high promise of future improvement. In wheat, corn, cotton, wines, oils, beef and pork products, the interests of the country are now so large and so affected by competing production of foreign nations, that this enlargement has been found absolutely necessary. In accordance with the requirement of Congress, there has also been added to this division a section of railroad statistics, charged especially with the duty of noting and co-ordinating the rates of transportation by land and water, with their changes and fluctuations. This work has been successfully initiated, and the railroads have generally furnished promptly the data required. Special investigation has been made during the year of the influence of American competition upon European agriculture. The statistics of the dairy have also demanded attention; the history of the progress of sorghum growing; the advance in economical meat production and early maturity of beeves; with investigations in various directions, for the use of the Department, for legislators, commercial organizations, and publicists.

The crops of the year 1883, as indicated by the returns of the Division of Statistics, will be sufficient for the wants of the country, and for an average measure of supply of deficient production of European countries. There was a large increase in the breadth of corn, due to the high prices of the last year. It encountered a period of excessive moisture and low temperature, followed by a summer of deficient rain-fall, resulting in a crop averaging scarcely more than 23 bushels per acre. As this is the third successive crop below the average yield of 26 bushels, the price continues high, and seems almost extreme, after a remarkable period of six successive years of yield above 26 bushels, in which the average price declined from 64.7 to 31.8 cents per bushel. The No-

vember estimate was 1,577,000,000 bushels. The winter-wheat crop was still more unfortunate, suffering severely by the alternations of frost and thaw in early spring. The spring wheat crop was good, yet the average yield of spring and winter wheat was but 11 bushels per acre, a reduction of nearly a hundred million bushels from the large product of 1882. The crop of oats was unusually large, barley medium, rye below average, and buckwheat seriously injured by the frost. Cotton is not yet fully harvested, but it is certain that the crop will be short, probably a million bales less than that of 1882, which was nearly seven million bales, as indicated in the report of last October, and verified by the cotton movement. Yet the present crop has only been exceeded twice in the history of cotton-growing, namely, in 1880 and 1882. The potato crop will be the largest since 1875, yielding not less than one hundred and ninety-five million bushels, of high quality, with little loss from rot. The results of the season's production may, on the whole, be considered successful and encouraging.

VETERINARY DIVISION.

The material portions of the report of the Veterinarian of the Department, and the results of the experiments and investigations of those employed under his direction, will be found in this volume. The report in its entirety, containing the results of the experiments of all those engaged in the investigation of contagious diseases of domestic animals, together with much valuable information voluntarily contributed by those interested in such matters, has been published by the Department in a separate volume containing over two hundred and seventy pages.

I have established near this city an experiment station for the investigation of contagious diseases of domestic animals. D. E. Salmon, D. V. M., who has been in the employ of the Department for a number of years, has been placed in charge of this station. One of the most important objects of this investigation is to test the practicability of a system of vaccination as a preventive for some of our most wide-spread and destructive diseases. The virus of swine plague has been successfully cultivated and attenuated, but it will require further investigation to determine its protective influence, and the danger, if any, attending its use. Very limited outbreaks of disease, supposed to be contagious pleuro-pneumonia, have been reported from Connecticut, Pennsylvania, and Maryland, each of which has been investigated by the Veterinarian, and will be fully described in his next report. While Texas or southern fever of cattle has not been so destructive in Virginia as last year, it has proved very disastrous in many other localities. During the year outbreaks of this disease were reported as prevailing in Pennsylvania, in Maryland, at Charlottesville and Norfolk, Va.; in Pawnee, Harper, and Barbour Counties, Kansas; in many places in northern Georgia and southern Tennessee, and at Fort Davis, Texas.

DEPARTMENTAL REPORTS.

The usual number of 300,000 copies of my Annual Report for the years 1881–'82 were ordered printed by resolution of Congress. Since that work went to press the following additional special and miscellaneous reports have been printed by the Department:

		No. copies printed.
No. 53.	Report upon the product and price of principal crops of 1882; also, freight rates of transportation companies, including changes of the winter tariff. December, 1882, 77 pp., octavo	11,500
No. 54.	Sorghum sugar industry. Address of the Hon. George B. Loring before the Mississippi Valley Cane-Growers' Association, Saint Louis, Mo., December 14, 1882. 19 pp., octavo	11,000
No. 55.	The Grange: Its origin, progress, and educational purposes, by Hon. D. Wyatt Aiken, of South Carolina. 18 pp., octavo	11,000
No. 56.	Report upon numbers and values of farm animals, of product and quality of cotton, and comparative values of American and European farm implements. Also, rates of transportation in Europe and America. February, 1883, 74 pp., octavo	11,000
No. 57.	Report on the distribution and consumption of corn and wheat, and the rates of transportation of farm products. March, 1883, 39 pp., octavo	11,000
No. 58.	Report on the area and condition of winter wheat, and the condition of farm animals; also spring rates of transportation of farm products. April, 1883, 46 pp., octavo	11,000
No. 59.	Report of the condition of winter grain, the progress of cotton-planting, and estimates of cereals of 1882, with freight rates of transportation companies. May, 1883, 65 pp., octavo	10,000
No. 60.	Report of average of spring grain and cotton, the condition of winter wheat, and European grain prospects, with freight rates of transportation companies. June, 1883, 56 pp., octavo	11,000
No. 61.	Report on the area of corn, potatoes, and tobacco, and the condition of growing crops in the United States and Europe, with a report on rates of transportation. July, 1883, 44 pp., octavo	11,000
No. 62.	Observations on the soils and products of Florida. By William Saunders, Superintendent of Gardens and Grounds. 30 pp., octavo	12,000
No. 63.	The grasses of the United States: being a synopsis of the tribes and genera, with discriptions of the genera, and a list of the species. By Dr. George Vasey. 47 pp., octavo	12,000
No. 64.	Report of the condition of crops, "American competition," and freight rates of transportation companies. August, 1883, 80 pp., octavo	11,000
No. 65.	Report of the condition of crops, and on freight rates of transportation companies. September, 1883, 55 pp., octavo	11,000
No. 1.	New Series Statistical Division. Report on condition of crops, yield of grain per acre, and on freight rates of transportation companies. October, 1883, 28 pp., octavo	11,000
	Area and product of cereals grown in 1879, as returned by the Census of 1880. 97 pp., octavo	10,000
	Report on jute culture, and the importance of the industry. By Prof. S. Watterhouse. 21 pp., octavo	5,000
	Report on forestry. Vol. 3, 318 pp., octavo	1,000
	Encouragement to the sorghum and beet-sugar industry: A record of practical experiments conducted under the direction of the Commissioner of Agriculture. 1883, 64 pp., octavo	5,000

	No. copies printed.
Bulletin No. 1. Chemical Division. An investigation of the composition of American wheat and corn. 1883, 69 pp., octavo	5,000
Preliminary report on the forestry of the Mississippi Valley, and tree-planting on the plains. 1883, 45 pp., octavo	5,000
Results of field experiments with various fertilizers. By Prof. W. O. Atwater, Ph. D. 1883, 183 pp., octavo	2,000
Bulletin No. 1, second edition. Division of Entomology. Reports of experiments, chiefly with kerosene, upon the insects injuriously affecting the orange tree and the cotton-plant, made under the direction of the Entomologist. 1883, 62 pp., octavo	1,000
Contagious diseases of domesticated animals. 1883, 271 pp., octavo	5,000
Investigation of sorghum as a sugar-producing plant, season of 1882. Peter Collier, chemist. 1883, 68 pp., octavo	2,500
Culture of the Date. By W. G. Klee, of California. 1883, 25 pp., octavo	2,500
Special Report No. 1, Miscellaneous. Address of Hon. George B. Loring before the American Forestry Congress, Saint Paul, Minn., August 8, 1883, 41 pp., octavo	12,000
Bulletin No. 2, second edition, Division of Entomology. Reports of observations on the Rocky Mountain locust and the chinch bug, together with extracts from the correspondence of the division on miscellaneous insects. 1883. 36 pp., octavo	1,000
Bulletin No. 3, Division of Entomology. Reports of observations and experiments in the practical work of the division, made under the direction of the Entomologist. 1883. — pp., octavo	1,200
Third report of the United States Entomological Commission, relating to the Rocky Mountain locust, the western cricket, the army worm, canker worm, and the Hessian fly, together with the descriptions of larvæ of injurious forest insects, studies on the entomological development of the locust and other insects, and on the systematic position of the orthoptera in relation to other orders of insects. With maps and illustrations. 1883. 451 pp., octavo	30,000

FORESTRY DIVISION.

Since the last report from this division was made, the work of ascertaining the facts relative to forestry in our country has been prosecuted as the means at the disposal of the Department would permit. The subject has so lately come up for distinct consideration among us, and the facts are numerous and to be gathered from so many sources and throughout so wide a territory, that for a long time to come the principal work of the division will be the collection of information upon which legislative action and commercial economy can be based. In the month of May last, three special agents were commissioned by the Department for the purpose of making personal examination of the country in respect to its forest condition, and to obtain facts relating to the subject. Reports from some of these have been received. Their report is very encouraging in regard to the practicability of successful tree-planting upon the dry and treeless plains of the Northwest. In the prosecution of our inquiries on the subject of forestry, this division is also discovering in other countries trees specially adapted to growth in arid

regions similar to our own, and methods of culture which can be adopted by us with promise of success. The expectation seems warranted, therefore, that there is no part of the country where, with proper care, such a growth of trees may not be secured as is desirable for the general welfare and for the comfort of the individual settler.

The importance of the work intrusted to the Forestry Division may be underrated through a failure to recognize the extent and value of forest products and their close connection with many of our most important industries. It has been estimated that two-thirds of the imports of Great Britain are of vegetable character, and one-third of forest products proper, amounting in value annually to £100,000,000. The total value of forest products for the census year is estimated at $700,000,000. It is only by comparison with the value of other known products that one can get the meaning of these figures. The largest single product of the country, as given in the Census Report, is that of Indian corn, valued at $679,714,499, though this is admitted to be an overestimate.

Other products are given, as follows:

Wheat	$474,291,850
Hay	371,811,084
Cotton	280,266,242
Rye	18,564,560
Oats	150,243,565
Barley	30,090,742
Buckwheat	8,682,488
Potatoes	81,062,214
Tobacco	36,414,615
Gold	33,379,663
Silver	41,110,957
Coal (bituminous)	52,427,868
Coal (anthracite)	42,110,957
Iron ore	20,470,756
Copper ore	8,886,295
Lead and zinc	4,182,685
Other minerals and irregular coal products	12,399,964
Total product of precious and other minerals	218,385,452

It will be seen on looking at these figures that the products of our forests exceed in value that of our crops of hay, rye, oats, barley, buckwheat, potatoes, and tobacco taken together. They amount to ten times the value of the gold and silver, of which we make so much account, and is more than three times the value of the precious minerals, and the coal and other minerals combined.

ARTESIAN WELLS.

The agent having in charge the locating and sinking of artesian wells reports, under date of October 28, that well No. 1, located 112 miles easterly from Denver upon Government land, on the Burlington and

Missouri Railroad, in Colorado, having been bored to a depth of 1,260 feet, and meeting with difficulties impracticable, if not impossible, to overcome, the work on it was finally abandoned, and a contract was then made with Wellington Smith, esq., an experienced well-driller, of Bradford, Pa., to bore a well near the station of Cheyenne Wells, Colo., on the Kansas Pacific Railroad, to the depth of 2,000 feet, if necessary, for the sum of $10,000. Work on this well was begun about the middle of June, 1883, and has been prosecuted with diligence till the present time. It is now down to a depth of 700 feet, and considering the difficulties encountered and overcome the work is favorably progressing, and it may reasonably be expected that the well will soon be successfully completed.

SEED DIVISION.

In the purchase of seed for distribution I have been careful to buy none but the best and of such varieties as would be of value to the section of country in which distributed. All the seed purchased has been carefully tested before being sent out.

Tabulated statement showing the quantity and kind of seeds issued from the Seed Division, Department of Agriculture, under the general appropriation act of Congress, from July 1, 1882, *to June* 30, 1883, *inclusive.*

Description of seeds.		Senators and Members of Congress.	Statistical correspondents.	Miscellaneous applicants.	Grand total.
		Packages.	*Packages.*	*Packages.*	*Packages.*
Vegetables	137	1,597,691	137,751	149,072	1,884,514
Flowers	81	143,553	40,960	48,927	233,440
Herbs	21	....	72	331	403
Tobacco	6	71,890	291	4,051	76,232
Tree	3	163	454	2,277	2,894
Sunflower	1	....	52	738	790
Opium poppy	1	....	....	13	13
Pyrethrum	2	....	96	210	306
Grape vine	.....	21,253	....	....	21,253
Strawberry	.....	20,653	....	....	20,653
Field seeds					
Wheat	7	56,780	16,464	3,065	76,309
Oats	3	1,994	4,315	5,335	11,644
Corn	3	11,130	200	1,500	12,830
Barley	1	5	....	....	5
Buckwheat	1	408	160	911	1,479
Potatoes	1	1,303	135	261	1,699
Rye	1	....	....	57	57
Sorghum	1	1,689	771	2,112	4,572
Turnip	11	86,148	....	....	86,148
Sugar beet	2	....	43	312	355
Mangel wurzel	2	....	25	79	104
Grass	5	2,712	1,022	2,212	5,946
Clover	3	149	108	366	623
Cow-pea	1	....	38	30	68
Artichoke	1	....	64	544	608
Millet	1	159	48	66	273
Rice	1	....	26	158	184
Textile					
Cotton	5	21,255	175	1,331	22,761
Hemp	2	....	38	46	84
Flax	1	....	4	43	47
Jute	1	....	22	812	834
Ramie	1	....	....	102	102
Grand total	.....	2,038,935	203,334	224,961	2,467,23

DISBURSEMENTS.

The following table exhibits in a condensed form the appropriations made by Congress for this Department, the disbursements and unexpended balance for the fiscal year ending June 30, 1883.

Object of appropriation.	Amount appropriated.	Amount disbursed.	Amount unexpended.
Salaries	$102,580 00	$102,575 49	$4 51
Laboratory	6,000 00	6,000 00	....
Collecting statistics	80,000 00	77,424 80	2,575 20
Purchase and distribution of valuable seeds	80,000 00	80,000 00	....
Experiments in the culture of tea	5,000 00	3,905 66	1,094 34
Experiments in the manufacture of sugar	*28,354 60	28,180 12	174 48
Experimental garden	7,500 00	7,500 00	....
Museum	1,000 00	1,000 00	....
Furniture, cases, and repairs	6,700 00	6,700 00	....
Library	1,500 00	1,476 82	23 18
Investigating the history, &c., of insects	20,000 00	20,000 00	....
Examination of wools and animal fibers	10,000 00	7,962 94	2,037 06
Investigating the diseases of swine, &c.	25,000 00	20,441 63	4,558 37
Reclamation of arid and waste lands	*20,085 26	12,429 13	7,656 13
Report on forestry	10,000 00	8,361 19	1,638 81
Postage	4,000 00	3,977 49	22 51
Contingent expenses	15,000 00	14,865 13	134 87
Improvement of grounds	8,000 00	7,941 62	58 38
Transporting and care of Atlanta exhibit	5,000 00	4,937 41	62 59
Erecting building for seed division	25,000 00	25,000 00	....
Printing and binding	15,000 00	15,000 00	....

* Including unexpended balance of appropriation for 1882.

There are a number of bills to be paid from the above balances which have not yet been presented for settlement.

Very respectfully,

GEO. B. LORING,
Commissioner of Agriculture.

REPORT OF THE VETERINARIAN.

SIR: I have the honor to submit the following reports embracing the more important investigations of the Veterinary Division of the Department of Agriculture during the past year.

Much time has been devoted to a study of the geographical distribution, the nature and rate of progress of the disease known as the Texas, Spanish, or Southern fever of cattle. These inquiries have led to the conclusion that the losses from this disease along the boundary line of the permanently infected district are heavier than has heretofore been suspected; that the infection is capable of withstanding a degree of cold that has always been believed to be fatal to it; that there has been for many years a steady advance of the infected district towards the North, and that the present line of infection is many miles beyond where it was supposed to be before these investigations were made.

It has long been known that cattle taken from any of the Northern States to some parts of the Southern States contract a disease which is very fatal to all but young animals, and it has generally been supposed that this was due to the increased temperature to which these imported cattle were necessarily subjected. It is now plain, however, that the disease contracted under these circumstances is precisely the same as that which is carried to the North by the apparently healthy cattle from Southern pastures; and that the region from which cattle are dangerous when carried to the North, corresponds exactly to that which is dangerous to cattle carried to the South.

The investigation of the nature of the contagion in this affection has proved, as was foreseen, a most difficult undertaking. A beginning has been made, however, which it is believed can be followed successfully, though it will require much time and careful confirmation of results before we can venture to reach positive conclusions.

The investigations of fowl cholera have been continued with a view of perfecting a system of inoculation or vaccination that might be used by all poultry raisers in rendering their fowls insusceptible to this fatal disease. The results of this line of research have been extremely important, and give promise of applicability to several other contagious affections of animals.

The report of Dr. Detmers on the diseases of sheep in Texas will be found very valuable, and it is hoped that it will enable the flockmasters of the Southwest to greatly reduce the present loss from preventable diseases.

Since these reports were written the Veterinary Division has been reorganized and an experiment station established, with your approval, near the city of Washington. Seven acres of land have been secured, upon which is a good brick house now occupied by my assistant, Dr. Rose. There are also three good stables capable of accommodating about sixteen head of cattle, four pig-pens 10 feet square, and a fowl house 30 feet by 15 feet. The fowl house, pig-pens, and one of the stables have just been built for the accommodation of experimental animals.

We have already instituted experiments with swine plague, fowl cholera, and the disease from which cattle have been suffering in this vicinity, and which has been supposed to be contagious pleuro-pneumonia. Investigations with Texas or southern fever will also be commenced within a short time.

The establishment of an experiment station for the scientific investigation of the communicable diseases of animals, diseases which are certainly to a large extent preventable, is unquestionably an important step in advance, and one that cannot fail to be productive of immense benefit to the live-stock interests of the country. Nearly all of the important civilized nations of the world have either provided for this class of investigations or are preparing to do so, and it is fitting that a country with such an enormous capital invested in animals and with such heavy losses from this class of diseases, should do as much in this direction as the most progressive nation in any part of the world.

Our laboratory is being fitted up to make researches of as high a class as are made in any other part of the world, and it is believed that when the work is once fairly underway, it will compare favorably with what is being done elsewhere. The field is still almost a new one, but there is no other department of scientific research which promises to accomplish more for mankind than this. From the agricultural stand-point it is, of course, the millions of dollars' worth of animals that are now swept away by communicable diseases that are to be saved; but it seems to me that we may be permitted to look even beyond this and to hope that a thorough investigation of the diseases of animals will do much towards preventing the loss of millions of human lives now victims to the same class of maladies. Nothing is more certain than that the contagious fevers of men and animals are due to causes of a closely related nature, and that any discoveries which are successful in preventing such diseases in animals will have a most important influence in saving human life. In the nature of the case the contagion of animals must be investigated before those of people can be successfully attacked, and, consequently, the wisdom of placing these investigations upon a scientific basis is apparent from whatever stand-point it is considered.

Respectfully submitted.

D. E. SALMON,
Veterinarian.

HON. GEORGE B. LORING,
Commissioner of Agriculture.

INVESTIGATION OF TEXAS CATTLE FEVER AND FOWL CHOLERA.

REPORT OF D. E. SALMON, D. V. M.

HON. GEO. B. LORING,
Commissioner of Agriculture:

SIR: I have the honor to submit a report of the investigations, made by me during the past year, in regard to the nature of the contagious and infectious diseases of animals, and the remedies which are applicable to them. These investigations have been confined to the two diseases known as Texas or Southern Cattle Fever, and Fowl Cholera;

and they have been pressed forward as rapidly as possible, considering the difficult nature of the subject and the many obstacles which have been encountered. In the following pages I have endeavored to so arrange the information obtained, and the accounts of the investigations, as to give a connected view of each part of the subject, and to bring out the bearing of the facts both upon these particular diseases and upon the general subject of contagion.

TEXAS CATTLE FEVER.

The investigations of this disease have been carried on from two different stand-points: First, to learn the present outlines of the permanently infected district, the rate at which this district is enlarging itself, and the amount of losses which annually occur along the slowly advancing line; secondly, to learn the nature of the disease, the character of its contagion, the manner in which this is distributed, preserved, and taken into the system, and, finally, the means by which it can be successfully combated. The facts bearing upon the first part of this inquiry were mostly collected by Maj. R. C. Saunders, of Evington, Va., who, as well as his assistants, Messrs. Benjamin Hubbard, R. C. Saunders, jr., and W. B. Shaw, has worked most intelligently and perseveringly in tracing out the many isolated cases and details which were necessary to establish the line of the infected district with any degree of certainty.

While directing, in a general way, the work of these gentlemen in Virginia, I have kept up the scientific investigations and accomplished as much as was possible under the circumstances. But the results of the year's work show very plainly that this disease is one which cannot be readily investigated without more facilities than have heretofore been at hand. The reason for this conclusion, as well as the proper manner of conducting the investigation, I hope to make apparent in the following pages.

The permanent home of the disease known as Texas fever was formerly believed to be confined to the Atlantic coast, south of North Carolina, and the Gulf coast from Florida to Texas; it was supposed to be the result of the climatic influences of this peculiarly malarial district, and as, when carried to the North, it had always disappeared with the first frost, the teaching has been general that the contagion could never exist through the winter beyond the line of frost and snow. Having already, in former reports, given many facts tending to show that a part of Virginia, nearly all of North Carolina east of the Blue Ridge, and the greater parts of the States of Georgia, Alabama, Mississippi, and Louisiana were long since overrun with this plague, I propose to call it the Southern Cattle Fever, as this would be a much more appropriate and less misleading title than Texas fever. The name, however, cannot be of much consequence as long as we understand the facts which I have already referred to; and as many of these facts are widely and, I might say, almost universally contested by those who pretend to understand this disease, I shall enter into the details at considerable length in regard to the evidence on which my conclusions rest.

Just here, it is necessary for me to remind the reader of certain characters of the disease which have been long known and are quite generally admitted, and which cannot be ignored if we would appreciate the bearing of the facts presented in this report. In the permanently infected district, and to avoid even the remotest appearance of error I refer at present to the Gulf coast from Florida to the Rio Grande, there are no remarkable losses among the native cattle from this disease. On

the contrary, the cattle are quite as healthy and look as well as we could expect, when we consider the scant and innutritious herbage on which they exist, the utter neglect which they experience through all seasons of the year, the excessively hot and dry summers, and the abundance of insect pests. Whether the stomachs of such cattle are abnormally reddened and present unusual signs of former ulcerations, or whether their spleens and livers are greatly enlarged, as Professor Gamgee seems to have demonstrated, it is foreign to my present purpose to inquire; but what I wish to dwell upon is the fact that there is no great mortality among the cattle in this district that can be attributed to this disease. Nevertheless, we call it an infected district, because when we take cattle there from New York, or Ohio, or Illinois, such cattle almost invariably contract a disease having all the characters of Texas fever; and to make sure that this is not the result of climatic influences, properly speaking, we have only to bring the native cattle from the Gulf coast among the herds of the North to communicate the same disease with all its symptoms.

The fact that the Gulf coast is infected with this disease is not shown, then, by any effect on the cattle native to that region, either when they are on their native pastures or when they are moved to the North, for in both cases they retain their condition of apparent health; but it is shown by the death of susceptible cattle taken to that section, and by the ability of the native cattle to carry the germs of the plague for hundreds of miles and to thus communicate it to the cattle with which they come in contact. I insist more particularly upon this fact because many who regard it as sufficient evidence that the Gulf coast is infected with a specific disease are either doubtful or altogether skeptical when it is applied to regions that are further north. But, when we come to examine into the matter, we find that there are just these two classes of facts, and no others, upon which we can rely to determine whether any given territory is permanently infected with the Texas fever contagion. If they are insufficient in regard to Virginia, they are equally insufficient in regard to the Gulf coast and any part of Texas; consequently, there would be no section infected with Texas fever, and, if not, there certainly could be no such disease, and the whole argument leads to a *reductio ad absurdum.* But Texas fever is a terrible reality; there are sections permanently infected with its germs; we know this by the kinds of evidence I have mentioned, and as we do not know the outlines of these sections we must establish them according to this same evidence. And so, when I have established the fact that cattle from the North, when taken to any particular county or town in the South, are almost invariably affected with the symptoms of Texas fever during the ensuing summer and fall; or when it has been shown that the cattle, from such a county or town, when taken further north disseminate a plague with similar characters, and, particularly, when both of these facts are discovered, I shall consider that county or town to be permanently infected with Texas fever.

There is no doubt that it is a difficult matter to understand, in the present condition of science, how it is possible for the native cattle of a section permanently infected with a contagious plague to resist the influences of the contagion with which they are surrounded; it is equally difficult to understand how apparently healthy cattle can distribute this contagion for so long a time after they leave the infected district; and it surely is not less difficult to understand why the cattle really sick of this contagious disease do not convey the contagion to others. But these facts are perfectly apparent from hundreds and thousands of ob-

servations, and they are just as true of the disease when it originates on the Gulf coast as when in North Carolina or Virginia; and, consequently, they cannot be accepted as tending to show that any district is uninfected so long as its cattle carry contagion beyond its borders, or so long as susceptible cattle die upon its soil.

DISTRIBUTION OF TEXAS FEVER IN VIRGINIA.

For several years I have been convinced, from isolated facts gathered here and there, that a section of territory in the southeastern part of Virginia was permanently infected with Texas fever. Just how large this territory might be, or how thoroughly the infection was disseminated over it, were questions which I was unable to decide, and on consulting the State authorities of Virginia, and many of the best informed and most intelligent of the stock-raisers, I found that there was a general and most profound ignorance of the whole subject.

The high price of cattle and the greatly increased number of these animals now being fed by the Virginia farmers has greatly stimulated the traffic and led to the purchase of young animals at a greater distance from home than ever before. But with the revival of this industry came the most terrible losses. Cattle feeding upon pastures where such animals had always before thrived would commence to droop and die, until 30, 50, and 75 per cent., and, in some instances, every animal, had perished.

While a few of the best-informed agriculturists of the State believed the trouble to be caused by the "distemper," or, as some called it, the "North Carolina distemper," there were not many who suspected its identity with the Texas fever, and by far the greater part of the interested farmers attributed their losses to some mysterious change in the atmosphere, the soil, or the character of the vegetation.

When, therefore, in accordance with your instructions, I visited Campbell and Bedford Counties, in the latter part of July, I found the cattle owners of a large district in the greatest consternation and alarm. Cattle were dying on every side. Men who had invested their all in stock with the hope of realizing largely because of the high prices, saw their capital melting away before their eyes and were powerless to prevent it. Great numbers of farmers were losing the small savings which had been accumulated by years of labor. On every hand was uncertainty as to the cause, how it had come, how it might be checked, and how prevented in the future.

A few days' study of the characters of the outbreaks, of the symptoms and *post-mortem* appearances of diseased animals, were sufficient to demonstrate the identity of the plague with that which has long been known to the veterinary profession as Texas or Spanish fever. But no Texas or Gulf-coast cattle had been brought here; even North Carolina cattle had been avoided, because there was a tradition that these were dangerous, and nearly all the trouble appeared, from the superficial investigation which I was able to make at the time, to proceed from animals purchased from the neighboring counties on the South.

At a public meeting of those most interested in the cattle industry of this section of the State, I pointed out the nature of the disease and the fact that the cattle had contracted it by grazing on pastures infected by animals from further South, and that if all susceptible animals were at once moved to pastures where none of these foreign cattle had been no further infection could occur; that even if cattle already infected should sicken and die on the fresh pastures, that would not affect the remainder,

for the reason that such sick cattle had never been observed to infect either other animals or the grounds upon which they ran; that native cattle, which had so far been kept from pastures on which the dangerous stock had traveled, were perfectly safe as long as they were kept upon such pastures; and, finally, that cattle could not be brought even from a few miles to the south, except, perhaps, in December and January, and allowed to travel over roads, commons, or pastures without the greatest danger to their native stock.

With these assurances much of the alarm disappeared; the mystery was cleared up; people saw what could be done with a hope of checking the plague; cattle which had not been exposed were kept rigidly isolated. And from this information, as the owners assured me, were saved some of the most valuable thoroughbred herds of cattle in the State—herds which had been collected, bred, and acclimated by the labor of a lifetime, and which money could not replace.

This was about all that could be done for the immediate suppression of the disease. The infected pastures would remain infected till purified by the frosts of the coming winter; the infected cattle would develop the disease in spite of precautions, and the diseased ones would not be greatly benefited by any known treatment. But another question of greater importance presented itself. A part of Virginia was without doubt permanently infected with Texas fever, and the cattle from that part were as dangerous as those from the Gulf coast, more dangerous, in fact, because there were so few who suspected them. The outlines of this section were unknown, and while such was the case, it was impossible to say where cattle could be bought with safety. The State could make no laws to control the movement of dangerous cattle nor to prevent the permanent extension of the plague, while people in other States had no opportunity to know that by buying cattle in this section they might destroy not only their own herds but those of the whole community. Again, there were facts which made it certain that the district permanently infected with Texas fever was gradually becoming larger, that the boundary line was moving farther and farther towards the north, and that within this line neither the frosts nor snows of severe winters were sufficient to exterminate the infection. It was of the greatest importance for us to learn the rapidity of this advance, and to collect, if possible, the materials which would indicate what measures might be adopted for arresting it.

To obtain this information required an enormous amount of work, and the patient collection of isolated facts which no one man could accomplish. It was for this reason that I appealed to the Department for those assistants who were so readily granted, and whose intelligent and careful inquiries enable me to rest my conclusions upon a much firmer basis than would otherwise have been possible.

LOSSES IN PREVIOUS YEARS.

It was not a leading object in this investigation to collect statistics of the many outbreaks of Texas fever that have occurred in Virginia during past years, unless there was a probability of these throwing some light upon the boundary of the infected district, the rate at which this boundary was advancing, or the measures for controlling the disease. The few cases referred to must not be taken, therefore, as a complete history of the disease in this State, but simply as examples of what has been occurring for years past over a large extent of territory.

In answer to inquiries, Maj. R. L. Ragland, of Halifax County, sent me the following valuable information, which I give in his own words:

I have never seen anywhere a more correct description of the cattle disease, which prevails more or less every year in this and many of the adjoining counties in Virginia and North Carolina, than is given on pages 253–255 of Department report on "Diseases of Swine and other Domestic Animals, 1879." I have no means of tracing its history ("distemper" as it has been called for more than half a century), but all authentic accounts agree that the disease was brought from Eastern North Carolina to Virginia—from the pine and swamp region of North Carolina, as stated by Mr. Lenoir, where it existed long prior to its appearance in this State. The disease was prevailing here when I was born, over fifty years ago, and prevails more or less every year. The cause of the disease is not known. It came from Eastern North Carolina sixty or seventy years ago, and progressed westward very much as stated by Mr. Lenoir.

One remarkable fact connected with the disease is that there are farms on which a case of the "distemper" has never occurred, while on the farms adjoining it kills more or less of the cattle every year. It is more prevalent and violent on some farms than on others. It rarely makes its appearance before July in this section, usually comes with *hot*, dry weather, and is most prevalent and fatal in August.

No known remedy can be relied upon. Red clay, salt, sulphur, saltpeter, and copperas, when properly mixed in right quantity, act as a preventive unmistakably.

In Washington and Russell Counties, the great stock-raising region of Southwest Virginia, there have been a number of outbreaks from imported cattle, but these have left no permanent infection. Thus, in September, 1867, 70 head of Texas cattle were pastured for ten days on the farm of Mr. Henry Preston at Wallace's Switch, Washington County. Six head of natives were running on the same pasture, but only two contracted the disease. These were valued at $50. All the native cattle on the farm became covered with the ticks, which so many think are the cause of the trouble, but none of those grazing in other fields showed any signs of disease.

Again, in May, 1868, 125 head of cattle were purchased by a Mr. Cunningham, near Memphis, Tenn., and were driven along the road by Mr. Preston's place. Mr. Preston's native herd of 65 head were driven along this road at various times from one pasture to another, but were never allowed to stop. The last of July the disease broke out among them and three died, which were worth $80. All the native cattle again became covered with ticks.

I mention these facts in regard to the ticks, because so many still cling to the theory that they are the inducing cause of the disease; and yet it is clearly seen from these cases that although all the native cattle were covered with ticks, but two died in the first instance and three in the second, and in either case only those which had been upon infected roads and pastures.

In the fall of 1868, 150 head of cattle were purchased in Texas, shipped to Arkansas and wintered, and about the 1st of May were brought to Bristol. The 6th of May they were turned out on a common near that town for about eight hours, thoroughly infecting it and causing a loss of 50 milch cows, valued at $1,500. They were then driven beyond the salt works, in Smyth County, infecting the road over which they traveled, and causing the death of 30 more cows, valued at $900. They passed through the Salt Works farm along a plantation road, and spread infection which destroyed 30 thoroughbred cattle, worth at least $1,200. This single drove of cattle, therefore, destroyed $3,600 worth of native animals.

In 1878 about 70 head of cattle were purchased in Marengo County, Alabama. These stopped for 36 hours at Mr. Preston's farm, at Wallace's Switch, the last of May. Mr. Preston's cattle commenced dying the 10th of August, and he lost 30 head, valued at $1,500. In this case,

too, all the native cattle were infested with ticks; and the calves which sucked their mothers up to their death were not themselves affected. This drove was taken to Glade Spring, and by infecting the roads and pastures along the route and at their destination caused the loss of 50 other cattle.

In the latter part of April, 1880, a drove of cattle was purchased in the neighborhood of Gainesville, Ala., and shipped to Bickley's Mills, Russell County. We have reports from five parties who together lost 59 animals from their infection, valued at $1,287.

In none of these instances have we been able to secure details of all the losses, but what we have presented are sufficient to demonstrate that all these counties are free from any permanent infection, first, because the native cattle proved so susceptible to the infection, and, secondly, because no losses have occurred after the succeeding winter in any case.

I now pass to a consideration of the evidence which establishes the outline of the infected district in Virginia. And, by way of explanation, I would remark here that as the infection has progressed towards the north and west, all that part of the State south and east of the line, which we have traced, may be regarded as permanently infected with the so-called Texas fever. While this is practically true, however, it is not absolutely true, for there are many farms, possibly, also, some neighborhoods, which have not yet become infected. For this reason every lot of animals from this section do not carry the infection, nor do all the animals brought from the north or west of this line invariably die. That the movements in both directions are extremely dangerous, however, is proved beyond the possibility of doubt.

REPORTS FROM PATRICK COUNTY.

This is one of the southern tier of counties, and is situated immediately east of the Blue Ridge.

Our first report is from a farm 1½ miles from the North Carolina line and 7 miles east of Carroll County. Cattle were lost here of this disease in 1872, and nearly every year since. Another report from a farm a mile farther west says that cattle have been lost more or less every year since about 1852. Still another report from a farm at the base of the Blue Ridge, 5 miles from the North Carolina line, tells us that the pastures and roadsides have been infected for twenty-five years, and that cattle have been lost on this farm for the last ten or twelve years. All the intelligent people of this section are of the opinion that the disease came from North Carolina, and has gradually extended northward. A gentleman, who lives 12 miles from Carroll County and 5 miles from North Carolina, bought five head of cattle from the top of Willis Gap, in March, 1882. Two of these died in May from Texas fever. The pastures at this place had been infected since 1872.

Coming now to Patrick Court-House, we have a number of reports from a section situated from 7 to 10 miles from the North Carolina line, and from 20 to 25 miles east of Carroll County. About $300 worth of stock had died from the disease this year, without any introduction of foreign cattle. All reports agreed in stating that the pastures here had been infected for about thirty years.

From Meadows of Dan, in the northwestern part of Patrick County, we have reports of three outbreaks caused by cattle brought, in one case, from Patrick Court-House, and, in two cases, from a section 15

miles west of Patrick Court-House and 4 miles from the North Carolina line.

There can be no doubt, then, that a considerable portion of Patrick County is permanently infected, that this infection has occurred within the last thirty years, and that cattle taken from this infected territory may infect the pastures on which they run.

REPORTS FROM HENRY COUNTY.

This county is situated directly east from Patrick, and, also, borders on the North Carolina line.

At Ridgeway the pastures have been infected for more than thirty years; at Horse Pasture, Spencer's Store, and Irisburg there is no doubt of the permanent infection, but we have no facts showing how long it is since this occurred. Going farther north we find that in the neighborhood of Burnt Chimneys, Mountain Valley, and Leatherwood the permanent infection has been of very recent occurrence. At Burnt Chimneys the roadsides have been infected since 1879; at Mountain Valley the pastures were infected from 1879 to 1881, and at Leatherwood some pastures were infected in 1881, others not till this year.

A large number of cases of the disease have been investigated in the section of the country between Martinsville and Traylorsville along Smith's River, and these show, very conclusively, that the infection is slowly advancing up this river, being about a mile farther on the south than on the north bank. Even in the sections which have been infected thirty or forty years, the native cattle are still dying every year in considerable numbers. This loss occurs principally among cattle running on the commons, while those on inclosed pastures from early spring till late fall generally escape.

We have one report showing that cattle taken from Henry County to Tazewell carried the infection and caused the death of 17 animals, valued at $350. This gives both lines of evidence proving the permamanent infection of the county.

REPORTS FROM PITTSYLVANIA COUNTY.

This county also borders on North Carolina, and is immediately east from Henry.

The losses of cattle have been enormous over most of the county for the last thirty or forty years, and continue to be extremely heavy. We have investigated cases of the disease in forty-six different localities, and all go to prove that the whole county has been overrun with the permanent infection. Our facts in regard to the rate at which the disease has advanced in this section are not as numerous or as accurate as we could wish, but they indicate that about 30 miles has been covered in twenty years. At present this advance has been checked by the Staunton River, which divides Pittsylvania and Campbell Counties.

Cattle from Pittsylvania have caused at least three outbreaks in Bedford and as many in Campbell County the present year, so that here again we have both lines of evidence demonstrating the permanent infection.

REPORTS FROM FRANKLIN COUNTY.

This county is directly north of Patrick and Henry and is west of Pittsylvania.

Here, again, the infection has followed the water-courses and advanced with very considerable rapidity. It has gained 12 miles on Snow Creek within three years, and has reached commons on Pig River 8 miles from the Pittsylvania line. This is abundantly demonstrated by the death of cattle running on such commons which had no opportunity for infection by foreign animals.

Four miles southeast of Union Hall the roadsides and commons have been infected for the last four years; and cattle taken from there to Union Hall this year carried the infection, and have undoubtedly caused permanent infection of the commons at that place.

There is, then, but a comparatively narrow district in the southeastern part of the county which up to this time has been permanently infected with Spanish fever. The losses during the year, so far as ascertained, were sixty head, valued at about $1,400.

REPORTS IN REGARD TO HALIFAX COUNTY.

I have already given the very interesting letter of Major Ragland, which shows that the southern part of this county has been infected for more than half a century. In 1880, a gentleman living at The Forks purchased nine head of cattle in Campbell County and took them to his farm. Of these six died, having commenced to sicken in April, as the result of grazing on permanently infected pastures.

In 1872 a lot of over 100 cattle was bought in the northern part of Halifax County, between Republican Grove and the Staunton River, and in the neighborhood of Brook Neal. These cattle were taken to Bedford County, and there infected a stable-yard belonging to Mr. David Kyle, from which 26 fine Short-Horns contracted the disease and died—a loss of $5,000.

In August, 1882, two head of cattle which were purchased in Halifax County were taken to the farm of Mr. Chapman Glover, at Glenmore, Buckingham County, where they infected his pastures and caused the death of nine natives. About the same time, 22 cattle from Halifax were taken to the farm of Mr. Howard Lewis, at Scottsville, Albemarle County, and infected his pastures, causing the death of three native animals.

A herd of 80 head at Green Hill, Campbell County, had been wintered in Halifax, just across the River, for a number of years. Last spring, probably from being moved too late, or because of the mildness of the winter, they brought the infection home with them, and twenty-three died during July and August.

These facts are sufficient to indicate that this county is infected throughout its whole extent; indeed, this was so evident that very little time was spent in investigating the many cases of the disease which occurred there during the year.

REPORTS FROM CAMPBELL COUNTY.

In the neighborhood of Brook Neal, in the extreme southeastern part of the county, cattle have been dying of Spanish fever nearly every summer for more than fifty years; and it has been well known that animals from the North or West were nearly sure to die. Cattle have died here the past summer, and a sufficient number of cases were investigated to satisfy us that the pastures are permanently infected. The infection has gradually extended in a northwestern direction from this as a starting point, being limited on the east by Falling River, and

on the west by Whipping Creek. In 1881 the commons about Pigeon River were poisoned, and they remained in this condition through the winter. A number of cases were investigated here, which show, only too plainly, that the border line of the infected district has now reached this point. The extension of the disease here has been very slow, probably because the infected territory was so narrow, and but 10 miles has been covered in fifty years. What makes this extension of greater significance is, that the Staunton River, which has held the disease in check, heretofore, and continues to do so to the west of this point, has here been crossed, and there is nothing now to stop the steady advance until the James River is reached.

REPORTS FROM CHARLOTTE COUNTY.

Our information from this county is very meager, and we have not the data to establish the line of infection across it in anything like a satisfactory manner. All of the northern and western parts of the county are evidently free from any permanent infection. The river has here held the disease in check, and caused the border line of the district to turn very considerably toward the south. The indications are that the infection is confined to the immediate vicinity of the northern bank, until we reach a point a few miles below the crossing of the Richmond and Danville Railroad. From here it has extended beyond the neighborhood of the river, the line of the district being apparently nearly parallel with the railroad and but two or three miles from it. At Mossing Ford and Keysville, on the line of the railroad, the losses have been quite severe during the summer, and it is probable that the commons at these places will remain infected in the future.

PRINCE EDWARD AND LUNENBURG COUNTIES.

We have no reliable reports from these counties. The line of infection, which becomes obscure as we leave the Staunton River, is here entirely lost, for the present, and we can only indicate it by conjecture. The greater part, if not all, of Lunenburg would seem to be infected, though it is possible that the extreme northwestern section is still free from it. Prince Edward is probably only infected in its eastern or southeastern part. Just as we were endeavoring to clear up the line across Charlotte, Lunenburg, and Prince Edward Counties, our inspectors were forced to their beds by malarial fever, and the work stopped. It was a great disappointment to have this part of the line left in so uncertain a condition, but the investigation can be resumed at any time.

REPORTS FROM BUCKINGHAM COUNTY.

The line of infection, lost above the Staunton River, becomes plain again at about the point where the Willis River crosses the dividing line of Cumberland and Buckingham Counties. Gravel Hill and Gold Hill are points which have been long infected. Diana Mills seems to be on the border line, and has been more recently invaded. This line, leaving the Willis River near where it crosses the county boundary, passes about 3 miles west of Gravel Hill, and from there leads nearly directly to Diana Mills; from this point again it leads down the west bank of the Slate River to the James.

REPORTS FROM FLUVANNA AND GOOCHLAND.

We have a number of reports from these counties, and, although many cases of Spanish fever occur in them from time to time, they have so far all been traced to cattle arriving the same summer from the infected districts south of the James. According to the best information at hand these counties are free from any permanent infection, the progress of the disease being still arrested by the river.

REPORTS FROM HENRICO AND HANOVER COUNTIES.

From many conversations with cattle owners about Richmond I have no doubt that the north bank of the James is infected at this point. The line of infection, according to the information at hand, leaves the north bank of the James some distance above Richmond and crosses Henrico County. We have not been able to closely investigate the many cases of disease which have occurred in this county during the year, and nothing short of this will enable us to locate the line with certainty.

In Hanover County, we know that Ashland and Hanover Court House and the sections surrounding these towns are permanently infected, though there seems to be a doubt if the cattle from here can infect susceptible animals when carried west or north. This probably arises from the recent infection of the district, and the consequent fact that many farms are still free from it; of course cattle from these would carry no contagion. The line of infection evidently strikes the Pamunky River just above Hanover Court House, but beyond here we have not sufficient information to locate even a conjectural line.

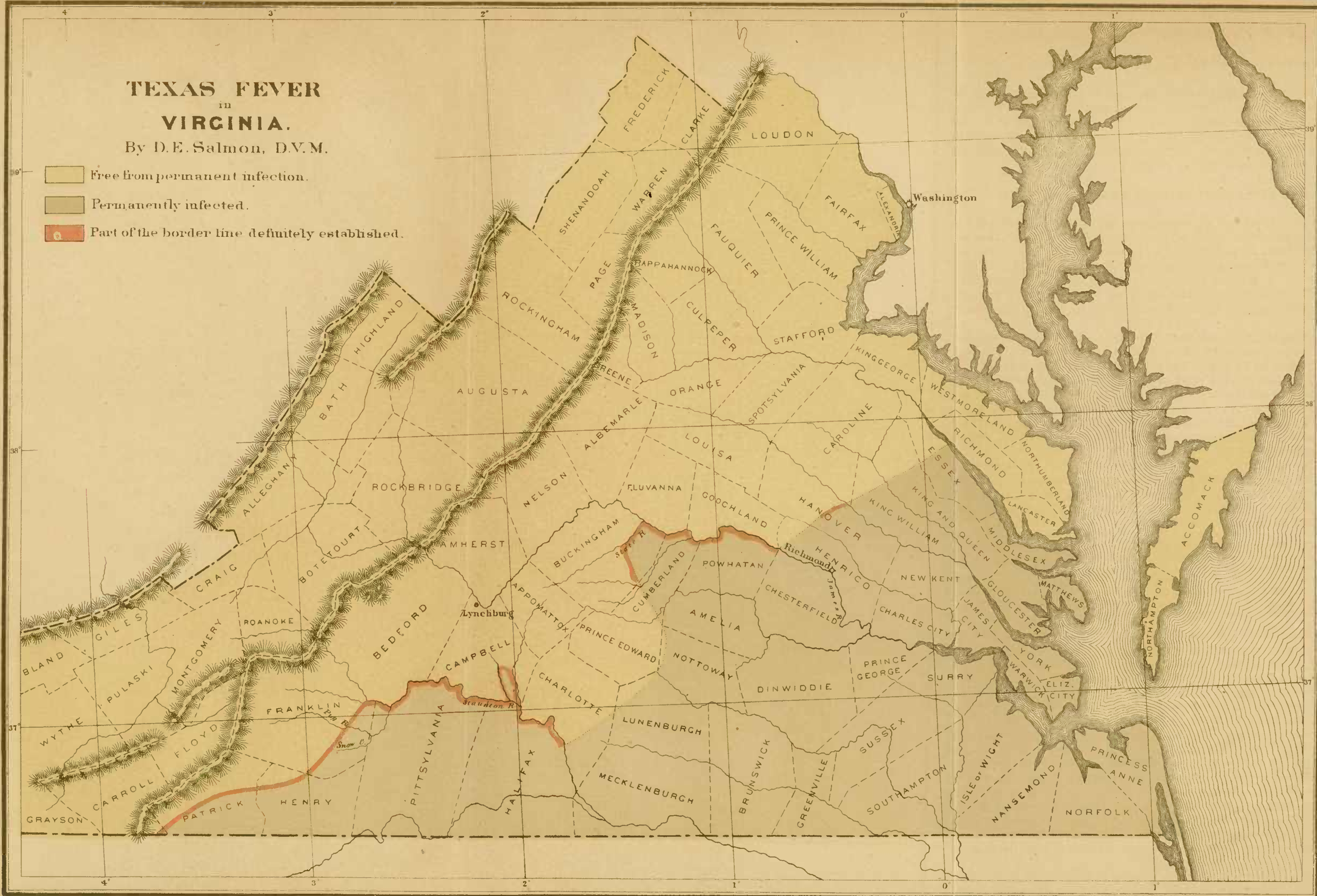
President Conrad, of the Virginia Agricultural and Mechanical College, who is the chairman of a committee appointed by the Life Members' Association of the Virginia Agricultural Society to assist in this investigation, has kindly written me as follows in regard to the doubtful district north of Hanover County:

> I learn that in Hanover County, above tide-water, and within a few miles of Ashland, the farmers will not allow the cattle from King William, King and Queen, Essex and adjoining counties to be brought among their native cattle, nor will they allow their cattle to pasture in what is known as the commons, for reason that disease is thus contracted, and death the result. So you need not consider these counties lying between the York and the Rappahannock Rivers as any longer *doubtful*, but as certainly to be classed in the group of infected and diseased counties.

It would appear, from this information, that a line drawn from Hanover Court House, in a northeasterly direction, along the boundaries of King William and King and Queen, across Essex to the Rappahannock, would not fail to any great extent in separating the infected from the still healthy territory south of this river. Has the infection crossed the Rappahannock and invaded the four eastern counties lying between this river and the Potomac? It is not improbable; but we have absolutely no information from this section at the time of writing this report.

In our investigations of the extent of the infected part of Virginia, we were continually being surprised at the advance which the infection has made. We were prepared to find the southeastern counties infected, but we did not expect to find this true of counties so far west as Patrick and Henry. Nor did we expect to find permanent infection in Buckingham, Cumberland, Amelia, Powhatan, or Chesterfield, and, still less, in the counties north of the James River.

The truth, then, as brought out by the investigations of this year,


TEXAS FEVER
in
VIRGINIA.
By D.E. Salmon, D.V.M.
Free from permanent infection.
Permanently infected.
Part of the border line definitely established.
Washington
Lynchburg
Richmond
LOUDON
FREDERICK
CLARKE
SHENANDOAH
WARREN
FAIRFAX
ALEXANDRIA
PRINCE WILLIAM
FAUQUIER
RAPPAHANNOCK
PAGE
ROCKINGHAM
MADISON
CULPEPER
STAFFORD
HIGHLAND
BATH
AUGUSTA
GREENE
ORANGE
SPOTSYLVANIA
KING GEORGE
WESTMORELAND
CAROLINE
ALBEMARLE
LOUISA
RICHMOND
NORTHUMBERLAND
ESSEX
ALLEGHANY
ROCKBRIDGE
NELSON
FLUVANNA
GOOCHLAND
HANOVER
KING WILLIAM
KING AND QUEEN
LANCASTER
MIDDLESEX
ACCOMACK
BOTETOURT
AMHERST
BUCKINGHAM
CUMBERLAND
POWHATAN
HENRICO
NEW KENT
GLOUCESTER
MATTHEWS
CRAIG
GILES
BLAND
MONTGOMERY
ROANOKE
BEDFORD
CAMPBELL
APPOMATTOX
PRINCE EDWARD
AMELIA
CHESTERFIELD
CHARLES CITY
JAMES CITY
YORK
NORTHAMPTON
PULASKI
WYTHE
FLOYD
FRANKLIN
PITTSYLVANIA
CHARLOTTE
NOTTOWAY
DINWIDDIE
PRINCE GEORGE
SURRY
WARWICK
ELIZ. CITY
LUNENBURGH
SUSSEX
CARROLL
GRAYSON
PATRICK
HENRY
HALIFAX
MECKLENBURGH
BRUNSWICK
GREENVILLE
SOUTHAMPTON
ISLE of WIGHT
NANSEMOND
NORFOLK
PRINCESS ANNE
Staunton R.
James R.
Snow C.
N Peters Lith, Washington, D.C.

demonstrates that we really underestimated the importance of the disease and the extent of its advance, in our former report, instead of greatly exaggerating both, as was assumed by some who felt called upon to criticise our conclusions. The facts in regard to the infected district and its gradual extension, which I have briefly summarized above, are sufficiently plain to need no comment. The importance of the matter is seen at a glance, and nothing which I can say would make this more evident, or render the necessity of controlling legislation more apparent to the most superficial thinker.

EVIDENCE THAT THE DISEASE IN VIRGINIA IS IDENTICAL WITH TEXAS FEVER.

As it has not been heretofore suspected that the disease affecting cattle over so large a portion of Virginia, North Carolina, and other Southern States, was identical with Texas or Spanish fever, and as many will doubtless feel inclined to contest this conclusion, I will briefly review the evidence on which it is based.

In the diagnosis of a contagious disease, there are three sets of facts to be taken into consideration: 1. The general characters of the disease as manifested by the classes of animals affected, the extent of the outbreaks, and the peculiar ways in which the contagion is spread. 2. The symptoms of the disease as observed with affected animals. 3. The appearance of the internal organs after death.

Fortunately, the investigations made by Professor Gamgee and by the Metropolitan Board of Health, in 1868, were so complete in regard to these points, as to leave nothing to be desired. We learn from them that Texas fever is in many respects a very peculiar disease, differing in its general characters, its symptoms, and its *post-mortem* appearances to a remarkable extent from any disease described in the veterinary literature of any part of the world. The native cattle in the infected districts seldom, if ever, suffered from it; milch cows, fat cattle, and working oxen were the classes of animals generally affected, while calves as a rule escaped; the disease was spread by apparently healthy cattle, and these cattle infected pastures for weeks and months after leaving their native country; it was only contracted from infected grounds; sick animals seldom, if ever, spread the contagion; a fence was sufficient to arrest the disease; the only kind of cattle that could be imported into the infected district with any safety was young calves; the disease almost invariably occurred in summer and fall, and was arrested by a frost. Surely this list of characters is so extraordinary, so different from what is seen with any other disease, that one could not hesitate to diagnose the affection from these alone, if he knew nothing of the symptoms or *post-mortem* appearances.

The symptoms taken by themselves are not so characteristic. The lopped ears, drooping head, staggering gait, high temperature, and bloody urine, are seen with anthrax, and perhaps one or two other diseases. The duration of the disease is, however, three or four times as long as with anthrax.

The *post-mortem* appearances are better indications than the symptoms. The enlarged spleen and liver and the engorged kidneys are also seen in anthrax, but the erosions and ulcerations of the stomach are characteristic, and these with the complete absence of the gelatinous exudations of anthrax are sufficient to exclude this disease. A still more important difference is the absence of the *Bacillus anthracis* or parasitic bacterium, now demonstrated to be the cause of anthrax.

Now, if we place together the general characters, the symptoms and the *post-mortem* appearances, we have so peculiar and distinct a combination that, when all are considered, it is impossible to mistake the disease. No veterinarian could hesitate for a moment in his diagnosis if all of these distinguishing characteristics were placed before him.

Very well; these characters and symptoms have been recounted to us, again and again, all along the line of the infected district in Virginia from the North Carolina line to the Rappahannock River. In regard to the *post-mortem* appearances, we have assured ourselves by many examinations, we have studied the blood and other liquids and solids under the microscope, and we feel that there cannot be a suspicion of doubt as to the disease which we have been engaged with.

Prof. John R. Page, of the University of Virginia, has kindly sent me the notes of a *post-mortem* made on a cow at Charlottesville, in which the lesions were so characteristic that I insert them in full with the accompanying remarks:

The subject was a large red cow resembling a short-horn grade, weighing over a thousand pounds, and said to have been in good condition previous to the fatal attack of disease. The animal, with a calf one month old, was purchased the 21st of September in the old stage yard in Charlottesville. While there a lot of cattle were driven into the yard, and it is said that there were diseased ones on the farm from which they came.

Symptoms.—The first symptoms of disease were manifested on the evening of October 6. There was sudden, almost entire loss of milk, loss of cud, and very high fever, drooping head and eyes glassy and fixed, urine lessened in quantity, deep-red or black in color, dung hard and lumpy. The fever and constitutional weakness became extreme, and the animal was in a state of frenzy, passing into stupor before death, which occurred on the night of October 9th.

Examination twelve hours after death.—The paunch and intestines were distended with gas, and the fat on the surface of the whole was tinged with a bright saffron yellow color. The blood vessels were filled with dark purple blood (congested). The paunch filled with undigested food, and the mucous membrane lining it black and decomposed. The maniplus or book was filled with a large quantity of undigested food between the folds or leaves, which was very dry, the mucous membrane being also black and mortified. The true stomach or abomasum was partially filled with fluid food-material, and its lining membrane was covered with dark purple mortified patches, running into each other all over the surface. The lining membrane of the small intestines was inflamed throughout its extent. The liver seen in its natural position was more than twice the normal size; its surface was covered with innumerable brick-dust colored spots, indicating a high grade of inflammation; when taken out and cut into the whole structure was found to be decomposed, of a dingy yellow color, and spongy in texture. The gall bladder was at least five or six times its natural size, of a bright yellow color, and filled with over a pint of dark fluid bile. The spleen or milt was ten times larger than usual, its surface mottled with yellowish or brick-dust colored spots; its structure utterly decomposed and filled with black grumous blood, rendering it difficult to handle without falling to pieces. The kidneys were both very much enlarged and diseased; the left was in a state of partial disorganization, its secreting structure being filled with dark blood. The urinary bladder was enormously distended with at least 1½ gallons of dark bloody urine.

With the vital organs as much diseased as was revealed by this examination, and the rapid course of the disease to a fatal termination, it is manifest that treatment of any kind would have been unavailing. The disease is unquestionably "*splenic fever*"—known to have existed during the summer months in lower tidewater counties from an early period of this century, during the extremes of dry or wet seasons, when cattle are moved about from place to place, especially from the south side of the James River northwards, and from low grounds to high lands, and *vice versa*. The disease has generally been known as bloody murrain, from the constant attendant symptom of bloody urine. Calves are said to be partially exempt from the disease, and young cattle sometimes recover, but milch cows and working oxen rarely survive an attack, this terminating fatally in the course of a week. The *post-mortem* conditions are almost identically the same as those seen in animals affected with disease in the lower country before the war, and long before Texas cattle were brought into the State.

In regard to the character of the disease as it appears in Virginia, much will be found in other sections of this report. The peculiar

features of Texas fever are seen in all the descriptions, from Patrick County in the southwest to Hanover on the northeast. That is, the inhabitants have learned from long experience that it is dangerous to import any animals from the North or West with the exception of calves; they suffer more particularly from the loss of milch cows; cattle on enclosed pastures which have never been infected are seen to be safe; the roads and commons are everywhere the great source of danger; apparently healthy cattle from counties south or east are connected with the dissemination of the contagion; the disease is everywhere characterized by the drooping head, lopped ears, staggering gait, and bloody urine. It is impossible for us to ignore the plain deductions from these facts.

The great agricultural writers of Virginia, who have molded public opinion for the past half century, have been almost unanimous in looking upon the "distemper" of this State as being simply a malarial or "bilious" affection, induced by the peculiar climatic conditions of the tidewater counties of Virginia and North Carolina. In this they do not differ greatly from the inhabitants of all the States south of them, even including the Gulf coast and Texas. But when a disease, whether of a "bilious" nature or not, may be carried for hundreds of miles from these malarial sections, when we see the infected territory gradually extending itself away from the tidewater, over hills and mountains into regions free from the so-called malarial and bilious diseases of people, causing greater destruction and showing greater virulence than our most dreaded plagues, it certainly deserves attention. Practically, it matters little whether we call it Texas or Spanish fever, distemper or murrain; whether our philosophical conceptions of it incline us to class it with the contagious fevers, or with the climatic, malarial, or "bilious" affections, the facts remain—we cannot shut our eyes to them—and any theoretical discussions which are intended to hide any of these facts must be looked upon as mischievous and dangerous in the extreme.

The disease is carried to the most healthful parts of the country, killing nine-tenths of the exposed cattle; the territory where this infection originally occurred spontaneously has increased by thousands and tens of thousands of square miles, and is continually advancing. These are facts which no amount of theorizing can affect, and sooner than neglect or ignore them, as has been done in the past, by the indolent philosophers, who prefer to give a week to idle speculation rather than an hour to active investigation, we had better forget that this disease came from a malarial section and that there are such names as Texas fever, distemper, and murrain. It has been the great object of this investigation to learn the facts, and, when these are once obtained, it is believed that there will be no trouble in forming theories to explain them.

To sum up, then, I believe it has been demonstrated beyond any possibility of successful contradiction: 1. That the district permanently infected with Texas fever is being continually enlarged by the advance of the infection towards the north. 2. That this infection has already reached in a part of Virginia to about 38° of north latitude. 3. That districts have been permanently infected for years not only at the line of frost and snow but where the temperature frequently descends to the neighborhood of zero, Fahrenheit. 4. That frost, snow, or even intense freezing cannot be depended upon to destroy the germs of this disease. 5. That while large rivers and mountain chains have checked the advance for a considerable time in the past, rivers at least have always been crossed in time, and there is, consequently, no apparent natural obstacle to the continued extension of the infected district towards the north.

THE LOSSES IN VIRGINIA FROM TEXAS FEVER.

It was so clearly impossible for me, with the small number of assistants at my command, to gather statistics of all the losses in a great State like Virginia, that I gave instructions to follow the line of infection, and, while tracing this and investigating individual cases, to obtain the number and value of all animals that were reported as lost. Since this was an object of secondary importance, and because the demonstration of the line of infection required more time than we could give to it, it followed, as a consequence, that no one went out of his way to collect statistics of losses. Those that are reported, therefore, represent but a small portion of the destruction even during the past summer; they are probably not one-fourth of what occurred in many of the sections which are mentioned, while equal, and in some cases greater, losses happened in many sections from which we have no reports whatever.

The following table is a condensed summary of the cases occurring during 1882, which it was necessary for us to investigate to establish the line of the infected district:

County.	Number of deaths.	Value.
Patrick	22	$631
Henry	32	675
Pittsylvania	67	1,039
Franklin	61	1,180
Campbell	126	2,596
Charlotte	75	1,450
Buckingham	40	876
Albemarle	47	1,191
Goochland	10	310
Bedford	18	490
Tazewell	20	400
Fauquier	18	360

Number of deaths investigated, 536. Value of these animals, $11,198.

The losses in Halifax, Chesterfield, and Henrico we know to have been large, but we have no reports specifying individual losses and values. Besides the cases included in the above, we have investigated outbreaks which have occurred in former years, and for the most part quite recently, in which 454 animals have died, which were valued at over $20,000.

The losses in this State, then, are annual and very heavy; so heavy, indeed, as to nearly arrest the development of the live-stock industry, which but for this disease would prove one of the best and surest sources of profit at the farmer's command. With the greater demand for cattle, and the buying of a larger number within the infected district, such losses must necessarily increase from year to year, unless some legislation can be devised and enforced which will limit or prevent the encroachment of such cattle during those months when the transportation of the active germs occurs. It is probable that not less than $200,000 worth of cattle die annually from this disease in Virginia, while in seasons of peculiar virulence, which frequently happen, several times this sum would not cover the ravages. In the counties now being infected a larger number of cattle are raised, and these are of better quality than in the counties which have generally suffered in the past, and for this reason, if the disease is left to itself, we must expect the total loss to the State will steadily increase from year to year.

ESSENTIAL NATURE OF TEXAS FEVER.

Among all the communicable diseases affecting our domesticated animals, it would be hard to find a single one the peculiar characters of which make it so difficult to investigate as Texas fever. In the first place the period of the year during which it occurs is extremely limited, being as a rule practically confined to August and September. There are, of course, many cases in July and October, but they are generally isolated, and before the investigator reaches the locality the animals are dead and too much decomposed to be useful for his purpose. Again, the period of the disease is so short and the plague so fatal that it runs through a herd and often destroys the susceptible animals, as in the case just mentioned, before the investigator can reach the ground and avail himself of the opportunity.

The fact that apparently well animals disseminate the contagion and that sick ones as a rule do not, is so completely at variance with what occurs with those diseases which have so far been successfully investigated that we have nothing in science to which we can turn with any hope of assistance. The investigator is thrown entirely upon his own resources, and, but for the fact that the instruments of to-day have reached a high degree of perfection, he would have little advantage, even now, over the physician who encountered similar problems a thousand years ago. And, when we consider that the instruments referred to cannot be used outside of a complete laboratory, and that they have for the most part been dispensed with in this investigation for want of such a laboratory, it will be understood that we have occupied very much the same position as the physician and veterinarian who have tried to grapple with these plagues during all the past history of the professions, and have continually and signally failed. If it had not been for our private laboratory, where our microscopical apparatus and reagents could be used to advantage, and where we had fitted up an incubator, imperfect for many purposes, it is true, but still one in which cultivations could be made very successfully, the scientific investigation for the year with this disease must of necessity have been a failure, as such investigations have so generally been in the past.

Finally, the success of investigators with other diseases has been due to the fact that they were inoculable maladies, that there was a known and sure method of producing them at pleasure, and that certain liquids of the body had been demonstrated to contain the germs even if the nature of these had not been discovered. With Texas fever, on the other hand, no one knew how to produce it for experimental purposes; no one knew that it could be inoculated, and we were assured by those who had investigated it before us that no part of the liquids or organs contained a virus, and that the plague could not be inoculated. Truly these were obstacles to contend with such as no successful investigator has encountered before. In spite of this, however, it will be seen that a substantial advance has been effected—one from which it will be possible to continue the investigations with much greater chance of success in the future.

The blood is free from parasites.—In his report to the Metropolitan Board of Health, of the microscopical studies of the solids and fluids of animals affected with Texas fever, Dr. R. C. Stiles says:

Quite early in this investigation my attention was attracted to the existence in the diseased bile of minute vegetable germs, which multiplied abundantly in the various specimens of bile preserved for analysis. They existed in the form of spherical or irregular aggregations of micrococcus, the nature of which could be determined only

by the employment of the highest powers of the microscope, and by studying their development. They were found in fresh blood and bile, but with difficulty. In specimens of bile collected in the evening they would be found abundantly in the morning; the white color of their aggregations contrasting with the yellow hue of the flocculi of the bile to which they were attached, and from which they seemed to be derived, their abundance being such as to preclude the idea of their derivation from any other source than the blood or the bile itself. Within a few hours of removal from the body numerous cryptococcus (or torula) cells, resulting from the development of the former, were found, often containing crimson granules. *

Billings and Curtis also concluded that in the blood, bile, and urine of cattle slaughtered in Texas, apparently healthy while alive, but presenting after death the appearances considered characteristic of the splenic fever, there are present minute bodies, corresponding to the micrococcus of Hallier, which exhibit the same behavior with reagents as the spores of fungi. †

Of course, in my search for the disease germs, it has been a primary object with me to determine if the blood of affected animals really contains either bacteria or the spores of any kinds of fungi. The blood for examination has always been obtained with the greatest precautions, vacuum tubes being filled directly from the veins and immediately sealed. When examined, after intervals of from a few hours to several days, such blood is generally found to contain granules resembling micrococci in certain respects. Many would decide at once that they were such organisms. The cultivation apparatus is a much better test for the nature of such bodies than the microscope, and, therefore, I have relied upon this. In none of the specimens of blood which I have tested in this way, though these were obtained from the jugular, the heart, the portal vein and the splenic vein, have I ever been able to discover any living germs. And, when I add that of a number of inoculations made with blood injected hypodermically no results have been produced, I think we may conclude that, as a rule, the blood contains no living germs in this disease, and that if the plague is due to a parasite this does not multiply in the blood before death.

The parasites of the bile.—Specimens of bile, obtained with equal precautions, give very different results. This liquid contains the most diverse organisms, sometimes schizophytes, and sometimes chains of higher fungi. Even in freshly gathered bile, these are easily discovered, and frequently all doubt of their nature is set at rest by the activity of their movements. In bile from animals affected with Texas fever, the diplococcus, which I shall soon describe as existing in the spleen, may be seen floating about in company with bacilli and bacteria. Cultivations of bile, however, have nearly always given an apparently pure growth of *Bacterium termo*. This is evidently due to the great activity of these bacteria, where the conditions are favorable to their multiplication; they are added to the cultivation liquid in equal or greater number than the other germs, and at once crowd them out and appropriate the oxygen and nutriment to themselves.

The bile, then, is not a suitable liquid in which to look for pathogenic germs; it is easy to find bacteria in it, but they may or may not be connected with the causation of the disease, and there is no possible method at our command for deciding this point.

If Drs. Stiles and Billings and Curtis found micrococci in the blood and bile, then, the discovery throws no light on the pathology of the disease; for those found in the blood were either granules of *débris* or

* Report of New York State Cattle Commissioners in connection with the Report of the Metropolitan Board of Health in relation to the Texas Cattle Disease, p. 131.

† Diseases of Cattle in the United States. Department of Agriculture, 1871, p. 156.

atmospheric bacteria, and those in the bile were in no way differentiated from the numerous septic forms which are always present in that liquid.

Micrococci of the spleen and liver.—These are the organs which present the most decided lesions in this disease, and they are the ones to which we naturally turn in our search for a *contagium vivum.* My first investigations of these organs were made by dropping small pieces in alcohol, these having been removed as soon as possible from an animal recently dead of the disease. After such specimens were hardened sufficiently, thin sections were cut, stained with aniline violet and mounted in balsam after the process of Koch. Sections prepared in this way plainly showed granules of the dumb-bell or figure 8 form, which were stained a different shade from any part of the tissue. I did not consider, however, that this was sufficient proof of their having been living germs; for if we rely upon one variety of test in such investigations, we can scarcely fail to commit such egregious blunders as for a long time characterized the greater part of the investigations of these diseases.

As a more secure test of the nature of these granules, I resolved to attempt cultivations of them; but this proved to be a more difficult matter than had been anticipated. The cases of the disease always occurred at a long way from the laboratory, and how to convey pieces of spleen a distance that required several hours, or even a day, to travel, without their becoming contaminated with atmospheric germs, was a problem of no small magnitude. Fortunately the spleen in this disease very frequently becomes disorganized, and the contents assume a semi-fluid consistency. It was found that, in these cases, vacuum tubes might be successfully filled with splenic pulp, though it was only with the greatest difficulty that they could be sealed, as the thick pulp formed a coating which prevented the cohesion of the glass.

August 1, 1882, I was successful in filling and sealing a number of tubes from the spleen of a cow which had just died in Bedford County, Virginia. The *post-mortem* appearances noted in this case were as follows: Animal not yet cold; fat slightly colored with yellow; petechiæ and large discolorations on external wall of heart, also on inner surface of the left ventricle near the apex, and on inner surface of right auricle; the third stomach impacted with dry food; mucous membrane of fourth stomach much congested, and with many erosions and ulcerous sores; liver engorged, gall-bladder much distended; spleen greatly enlarged, very dark and partially disorganized; bloody discoloration of tissues around the kidneys, and engorgement of these organs; bladder distended with claret-colored urine.

August 7, one of these vacuum tubes was examined microscopically. No decomposition whatever had occurred. Besides the *débris* of the spleen, there were blood corpuscles of perfect form and granular cells or lymph corpuscles. Then there was a large number of spherical granules united by twos, or, in other words, dumb-bell micrococci, or diplococci, as we choose to call them; also, some rod-like bodies not very numerous and suspected, from their appearance, to be coagulated fibrin. In the specimens stained with aniline violet the rods were invisible, but the granules, or diplococci, were very plain.

Two cultivation tubes were infected with some of this pulp as soon as the vacuum tube was opened. The next day both were turbid, and something had evidently multiplied in them. One was examined and found to be a pure cultivation of diplococci, without any power of movement; they resembled fowl-cholera micrococci, but were smaller. The second was an impure cultivation, containing diplococci in abundance, but also bacilli.

August 8, my assistant, Mr. W. B. Shaw, slaughtered an animal that had been sick several days, and sent me vacuum tubes filled from the spleen, the gall-bladder, the splenic artery, and the portal vein. The lesions in this case were sufficiently characteristic of the disease, viz., enlarged and softened spleen; enlarged liver; distended gall-bladder, blood extravasations on spleen and heart; ulcerations about pyloric extremity of stomach, and discolored urine.

The tubes were received the 10th of August. Two, containing splenic fluids, were in excellent condition, the coagulum being firm, and the serum light-yellow and not at all stained with the red coloring matter of the blood. Both contained the diplococci found in the former case. The tube containing bile had a plain odor of putrefaction, and the liquid swarmed with bacilli, vibrios, bacteria, and a few diplococci. Cultivations of the splenic liquids developed only diplococci exactly similar to those obtained from the former case, but having rather more of a tendency to adhere and form short chains. Blood from splenic artery, placed in a cultivation apparatus, proved to be entirely free from living germs. The diplococci were carried through four cultivations, without any change in their appearance or manner of growth.

Owing to the difficulty of obtaining suitable cases, and of sealing and transporting the vacuum tubes, these were the only reliable investigations of the splenic liquids; but they are sufficient to prove that a parasitic schizophyte multiplies in the spleen in cases of this disease. I have no desire to exaggerate the importance of this discovery; it undoubtedly needs confirmation, but this, I feel assured, will not be lacking if the investigation is continued through another summer.

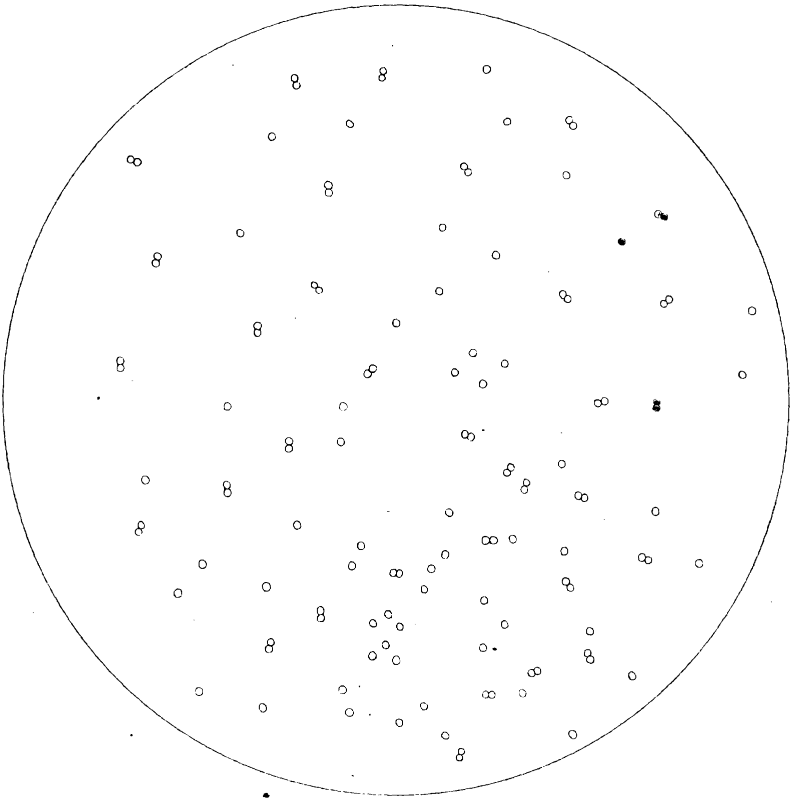
Inoculations with splenic pulp.—In 1880, two inoculations were made with splenic pulp, one of which produced a very severe case of the disease, the second a much milder attack, though accompanied with great elevation of temperature. These experiments were detailed in my last report; and, while they indicated the inoculability of the disease, they needed confirmation. To this end the following experiments were made:

Experiment No. 1.—The splenic pulp, remaining in the vacuum tube August 7, after the cultivations were infected and the microscopic preparations made, was diluted with 2^{cc} of water and injected, in equal quantities, under the skin of a steer and heifer, each being about two and one-half years old. These animals, for more perfect observation, were kept stabled. Neither showed any ill effects whatever from the inoculation.

As many other experiments on stabled animals failed during the summer, it occurred to me that, perhaps, keeping the animals stabled and out of the sun had something to do with this result. I knew that there was a general impression that stabled animals were less liable to be attacked spontaneously, but I had partly concluded that this was due to their not being exposed to the contagion, since I had investigated a number of cases that had occurred with stabled cattle farther south. On more mature reflection, however, it seemed that stabling might have a most decided influence on the appearance of the disease, in a cool climate, such as we have in this mountain section. The disease only appears spontaneously in the hottest weather, and is checked by a few cool days, to commence again with the return of the heat. Then, animals which are overheated by driving in the sun have frequently developed the disease when they probably would not have been affected if allowed to remain quiet. These reflections decided me to make some more inoculations of cattle in the open fields.

TEXAS, OR SOUTHERN CATTLE FEVER.

Investigations of D.E. Salmon, D.V.M. Plate I.



Texas Fever: Micrococci from the spleen as seen in the cultivation liquids. x1000.

The 3d of October I obtained some fresh material by killing a cow in the last stages of the disease, at Bellevue, Va. Her temperature before death was 105°. The spleen was much enlarged and softened. Other organs were not closely examined, as we just had time to obtain the splenic pulp and get a train that would take us to where our cattle were grazing. The symptoms, however, were so plain as to leave no doubt of the disease.

Experiment No. 2.—The afternoon of October 3 we inoculated, by hypodermic injection, in the side of the neck, a large white cow, with the splenic pulp obtained in the morning. This cow was in excellent condition, and was selected on that account as being, probably, more susceptible. A small heifer was also inoculated in the same manner, and a steer, about two years old, was drenched with about two drachms of the pulp that was left from the above inoculations. These animals were in a field with ten or twelve others. I was unable to watch, personally, the effect of this experiment, but my assistant, Mr. Shaw, reported to me that the cow was taken sick October 13. The following day the symptoms were very intense; she was lying with head stretched out and ears drooping, and appeared to have high fever. When made to walk, the gait was staggering, there was knuckling at the fetlocks, drooping head, and lopped ears. She was not observed when voiding urine, but near where she was lying was the evident appearance that this had lately been done, and the remains upon the grass indicated that this liquid had been highly charged with blood. This animal died during the night of October 16, the neck and shoulder from the point of inoculation having become considerably swollen. The young animals seemed ailing for a day or two, standing by themselves and appearing dull, but in neither case was there any serious sickness.

In this experiment we have not only a very evident confirmation of my former investigations, but it is proved to us that young animals cannot be relied upon to give results. The disease is, then, inoculable, and the splenic pulp is the material which contains the virus. Out of five inoculations, with this material, we have produced three plain cases of the disease. Surely, then, it can no longer be maintained that this is not an inoculable fever.

Inoculations with cultivated micrococci from splenic pulp.—The discovery and cultivation of a schizophyte, in a state of purity, is no proof of its pathogenic action; the disease must be produced by inoculations with the organism that has been cultivated in a liquid known to be harmless. Having discovered that the splenic pulp of diseased animals acts as a virus when inoculated upon susceptible subjects, and that this pulp contains, apparently, but one organism, the next step in our investigation was to test the effect of inoculations with the cultivated parasite. Accordingly, the following inoculation experiments were made with the cultivated micrococci:

Experiments Nos. 3 *to* 7.—August 14, five head of cattle were inoculated by hypodermic injection of the first and second cultivation of diplococci, in the quantities named. No. 1 received $1\frac{1}{2}^{cc}$ of first cultivation; No. 2, same quantity of second cultivation; No. 3, 2^{cc} of second cultivation; No. 4, 3^{cc} of second cultivation; No. 5, 7^{cc} of first cultivation. These inoculations produced no noticeable effect.

Experiments Nos. 8 *and* 9.—August 27, 20^{cc} of the second cultivation was injected under the skin of No. 4, and a like quantity of the third cultivation was administered in the same manner to No. 6. These also were without result.

Experiments Nos. 10 *and* 11.—September 1, No. 4 received, by hypo-

dermic injection, 24^{cc} of a fourth cultivation, and No. 6, 15^{cc} of same liquid. This was followed by some coughing, elevation of temperature to $104\frac{1}{2}°$, and constipation of bowels, but whether there was any connection between this result and the inoculation could not be determined. It is certain that there was no serious illness in any case.

What conclusions are we to draw from these experiments? They are certainly negative. They do not show that our diplococcus is the cause of the disease, nor do they show that it is not. These cattle were not good subjects, though they were the best that could be obtained. They were too young, not fat enough, and, besides, were stabled. I have already shown that two of them resisted inoculations with splenic pulp, which in some cases has proved extremely virulent. Again, the pulp had been inclosed for several days in vacuum tubes, and the cultivations were allowed to stand for some days in contact with the air before they could be used. Pasteur's recent investigations show us what disastrous effects such treatment may have on certain kinds of virus. It seems to me, therefore, that this micro-organism must be studied more carefully before we can reach anything like definite conclusions in regard to it. The fact that the splenic pulp causes the disease, and that this appears to be the only germ which is contained in it, is certainly very strong evidence of its connection with the virus. Such failures in experiments are what must always be expected in investigations of difficult questions, and, while they are somewhat discouraging, they at least give us new ideas in regard to the future direction of our work.

THE DISSEMINATION OF TEXAS FEVER.

We know that an animal in apparent health, coming from the district permanently infected with Texas fever, may poison the pastures upon which it travels to such an extent as to prove fatal to a large majority of the susceptible cattle which graze upon them. How is this poison carried, and in what manner distributed? Does it exist in the saliva, as asserted by some? Is it disseminated with the droppings, as supposed by others? Or is it carried in the hair as impalpable dust? Evidently these are questions of considerable importance to us in our endeavors to devise means of preventing the continual extension of the disease. It was a part of my plan to elucidate such questions by the experiments of the past summer, but there were so many unknown difficulties to contend with that the success was not flattering.

Inoculations with excrement of Southern cattle.—One of the most reasonable suppositions, in regard to the infection of pastures is, that this occurs from the solid excrement of the Southern cattle. These cattle have acquired an immunity from this disease because it is one of the non-recurrent fevers, and it is not at all probable that the germs would multiply in the body of an insusceptible animal to a sufficient extent to be distributed by the urine. The digestive cavities are practically outside of the body, however, and, from the character of their liquids and the temperature at which they are kept, they are extremely favorable for the multiplication of micro-organisms of the class to which disease germs belong. It is, therefore, highly probable that the germs of this disease taken into the alimentary canal of even insusceptible animals in large numbers would multiply for several months, and be distributed during all this time with the solid excrements.

To test this theory cattle excrement was taken from the Savannah stock-yards in May, placed in tin cans, and used for inoculating pur-

poses within three days. The following are the details of the experiments:

Experiments Nos. 12 to 15.—Fresh cattle excrement was taken, May 20, at the Savannah stock-yards and sealed in tin cans. May 23 a part of the droppings from cattle that had been shipped from South Carolina just opposite Savannah was mixed with that from cattle that came from Coffee County, Georgia. The whole was rubbed in a mortar with a three-fourths per cent. salt solution until a thin paste was formed. This was filtered through two filters of fine cotton cloth to remove the coarser particles. The filtrate contained a variety of bacterial forms, a large majority being of the dumb-bell shape. Four cattle received hypodermic injections of this filtrate in the dose of one drachm. To one of the animals, three ounces were administered by the mouth in addition to the hypodermic injection. The animals were carefully examined and the temperature taken daily, but there was no marked disturbance of the general health. At the point of inoculation in each case there was very considerable swelling and tenderness which terminated in an abscess. The pus of these abscesses swarmed with an organism which is probably identical with the one described by Pasteur as a *pus generator*.

Here, again, our result is not at all satisfactory, because it the germs of Texas fever were present in the excrement they may have been overcome by the pyæmic germs, or the weather may have been too cool, or the cattle not susceptible enough for the development of the plague to occur. There are so many elements of uncertainty in regard to this disease that the whole subject requires a thorough experimental investigation before any safe conclusions can be reached.

Is the disease spread by other means than infected pastures?—Those who have given much time to the investigation of Texas fever, in the past, have, so far as I am aware, been unanimous in the conclusion that the disease is only contracted from infected grounds. In other words, that the germs are not disseminated through the air, or conveyed in any manner directly from one animal to another. Within the last year or two different views have been advanced, and, in some cases, by members of the veterinary profession. Generally these have been based upon theoretical considerations and reasoning from what is seen in other affections to what we ought to see in this one. In one or two instances the superficial observation of a few cases has seemed to support the opinion that the disease might be contracted directly from sick animals, or even that the infection might be carried a considerable distance through the air. It has also been stated that calves contracted the disease from their mothers. A brief review of the observations bearing upon this point is, therefore, advisable at the present time, when the interest in regard to the possible means of preventing the disease has become so great.

Turning to the report of the New York State Cattle Commissioners in connection with the report of the Metropolitan Board of Health, 1868, we find that Dr. Manheimer, who investigated the many cases occurring in the Fifth Ward of Chicago, stated:

> It seems that the native cattle do not communicate the disease to each other, as in many instances cows were housed in the same stable with sick cows without being infected. * * * In a circuit of about two miles only one cow escaped the disease, and that one was kept in the stable for the last three weeks (p. 82).

Mr. Hosack, cattle inspector of Pittsburgh, Pa., reported as follows in regard to cases at that point:

> The only cattle that were affected were the two droves from Illinois. * * * All the cattle on that train were more or less affected. After their arrival they were

placed in the stock-yards near other cattle, in fact I can say they were surrounded by other stock, but in no one instance did the disease show itself save in the two herds above spoken of (p. 84).

E. C. Hall, clerk of the board of trustees of Onarga, Ill., wrote:

At Loda, a railroad station about 16 miles south of here, there was a load of Texas cattle unloaded from the cars and driven east across the country to Indiana, which I believe is the northern limit where the disease has been. The native cattle there having communication with the Texas cattle, or herded upon their track or herding grounds, have become diseased, and it has been very fatal, sweeping off nearly whole herds. The cattle in pasture along the track have not been affected. One farmer who had his stock a part in pasture and a part on herding grounds (open prairie)—those herded, many of them died; he put the two herds together in pasture, and not a case occurred among those that had been pastured (p. 85).

Fred. A. Atkins, of Odell, Ill., wrote:

In conclusion, I would say that I have no reason to believe that native cattle, even under circumstances the most favorable for infection, will infect other native cattle. Not one of the many cases I have seen die of this disease but that was exposed to infection from Texas stock; and not one of those in this vicinity now living but that was exposed to sick native cattle. I have seen a calf, which is now living and in good health, that was suckled in succession by three different cows which died of this disease in its most aggravated form. The little animal drew its food from them while they were sick, and when the first died it was given to another, and so on, and the process had no deleterious effect upon its health (p. 86).

Dr. Thomas L. Neal, health officer of Dayton, Ohio, reported:

No instance occurred where a native contracted the disease which had not been exposed directly to the ground where the "long horns" had grazed (p. 87).

Dr. J. F. Hodgen, president of the Saint Louis board of health, made the following statement:

Cattle running about the stock-yards where Texas cattle are received are affected, while others near by, but kept up closely, are not diseased (p. 88).

Dr. James W. Clements, late health officer of Saint Louis, wrote:

I met with or heard of no cases among cows kept confined either to stables or their own pastures except one instance. A large dairyman, in June, purchased some forty head of cows in Illinois. Shortly after arriving at his farm a disease appeared among them from which they died rapidly. The disease did not show itself among his old stock; this may have been due to the segregation of the Illinois or sick ones (p. 89).

The instance referred to here is no exception to the rule, as was supposed by the writer. The purchased cows had been driven over infected grounds on their way to their new home, and contracted the disease in this way. The fact that the home stock was not affected is another strong confirmation of the rule which has been so long accepted as true.

V. P. Chilton, of Southwestern Missouri, stated:

I have had my own cattle separated from large herds of Texas cattle by a fence without any evil results, and of the immense number that have died on this road none have died on pastures from which Texas cattle have been excluded. The instances to sustain this view are so numerous that I will not undertake to give them (p. 93).

Professor Gamgee, after a very extended trip through the affected districts, came to the conclusion that there was not a single instance to show that sick Northern animals had induced any disease, either directly or indirectly. (Report, p. 115.)

Dr. W. S. Morton, of Cumberland County, Virginia, published a treatise on the Distemper of Cattle, in June, 1854, in which he stated:

> For many years I kept two herds on the same farm—one infected, the other sound A man with a *white skin* was sent to pull and leave down the barrier between them Unfortunately, before matters could be rectified, a sound ox walked, grazing, for nearly 50 yards on the infected grass. He died of distemper in a few days. I kept those two herds separated from the last of June until nearly Christmas.*

In the outbreak on the farm of Henry Preston, at Wallace's Switch, Va., in 1878, it was noticed that the calves never showed the least evidence of disease, though suckled by their dams up to the time of death. At the same farm, in 1868, three of a herd of 65 were infected and died without the disease extending to the rest of the animals.

During my experiments in 1881, two cattle contracted the disease from inoculation, and though confined in rather a large yard with six others, none of the latter were affected with the plague.

The three animals which were last October infected with splenic pulp of a diseased cow were grazing on a pasture with about a dozen others, and though one of the infected ones died and the other two were sick, the remainder of the herd retained the best of health.

From all parts of the line examined during the summer and fall, my assistants reported to me that the farmers were able to preserve their cattle, even when surrounded by permanently infected commons, if they kept them securely fenced on pastures to which the disease had never been carried.

We have, then, a mass of independent testimony, coming from all parts of the country, which is practically unanimous in asserting that susceptible cattle do not contract Texas fever either from Southern cattle or from sick natives. I have so far seen no reason to doubt that this conclusion is correct, and when I am told that in a Northern State, during the past summer, Texas fever was contracted at a distance of 150 yards from any source of infection, and that sucking calves contracted the disease from the cows, I am inclined to believe either that the facts were not carefully observed or that there was a mistaken diagnosis, and that the disease was not Texas fever.

Are pastures ever infected by sick natives?—If the observers of Texas fever are practically unanimous in concluding that the disease is never conveyed directly from one animal to another, this is far from being the case in regard to the ability of sick animals to infect pastures. It is true that in all the observations of 1868 there were but two cases where it seemed at all certain that pastures had been poisoned by sick Northern cattle. In regard to these, however, there was little chance for doubt. In my own investigations, I have generally found that sick natives were harmless, but there seem to be occasional instances, particularly where they have pastured on permanently infected lands, in which they carry the poison and infect lands that were previously safe. I give below a few examples of such supposed infection as reported by my assistants:

Dr. Watkins, of Martinsville, Henry County, Virginia, bought 16 head of cattle 10 miles east of Appomattox Court-House, in February, 1875. There had been no infection on his place for forty years. A steer, belonging to a negro on the farm, got out of the pasture and went up the river, where the disease was at the time. He was brought back and put in with the other cattle, but died soon after. The Appomattox

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* Quoted from report of Dr. J. M. Hines.

cattle all contracted the disease and died, though this was three years after they were brought to the farm.

Dr. Stovall, of the same place, had two milch cows on his farm, where there had been no disease for twenty years. Two yearlings, which had sickened on the neighboring common, were placed with the cows and died in a few days. Both cows contracted the disease and died.

B. S. Jones, of Ridgeway, Va., took a cow from the common and placed her on the same pasture with other cattle. She had been infected on the common, contracted the disease, and died. Two of the other cattle afterwards sickened and died.

V. Brooks, who lives not far from New Canton, Buckingham County, Virginia, drove a yoke of oxen to New Canton and back home in 1879. They contracted the disease from infected roads, and before dying infected his home pastures, causing a loss of seven other cattle.

It would seem from such facts that sick cattle may occasionally infect pastures, especially if they have contracted the disease on permanently infected lands. But these instances are so few, compared to the cases where, under exactly the same circumstances, they have been perfectly harmless, that we are almost tempted to believe that the infection in these cases might not have been correctly traced. Still, there seems to be no apparent reason why a susceptible animal may not carry the germs from a permanently infected pasture as well as an insusceptible one. The reason that, in the Northern States, the sick cattle do not disseminate the contagion may be because the pastures on which they have grazed were not so thoroughly saturated with the disease germs as are the permanently infected lands of the South. It seems best, therefore, for us to keep these facts in mind, and, until we understand more of the germs and of their habits of life and the way in which they are distributed, to consider that, under certain circumstances, sick animals may be a source of danger.

Rate of advance of the infected district.—In collecting other facts in regard to Texas fever, I have endeavored to obtain data which would enable us to determine the rapidity with which it is advancing, and the time which it will require in the future to gain a certain distance. The evidence bearing upon this point is still very insufficient, but it is not without considerable value; it certainly gives us a more definite idea of the matter than we have ever had before. The most rapid progress, for a long series of years, has occurred in the State of North Carolina, in the extension of the disease across the State from east to west.

About fifty years ago, as would appear from laws enacted at that time, the border line of the infected district was somewhere east of Raleigh, where the character of the timber changes and the long-leafed pine appears. This line is now at the Blue Ridge Mountains, a distance of at least two hundred miles, or an average of four miles a year. There is no other example of such rapid progress, probably because, the same parallel of latitude being followed, there was less change of climatic conditions than is encountered in going the same distance toward the north.

In Habersham County, Georgia, from information which I obtained during a visit to that section in 1881, there appears to have been an advance of about twenty miles in the course of ten years, or two miles a year. As this progress was made through the foot-hills of the Blue Ridge, to a considerable extent, the conditions must be regarded as unfavorable for the extension of the infection.

In Franklin County, Virginia, it has advanced westward twelve miles in three years, or four miles a year, a rate equal to that in North Carolina

but for a much shorter time. In the neighborhood of Burnt Chimneys and Leatherwood, in Henry County, Virginia, the progress has been rather over three miles a year for the past two or three years. The rate of progress in various parts of Pittsylvania County, as near as I was able to ascertain, was about fifteen miles in ten years, or one and a half miles per annum. In Halifax County it does not seem to have advanced more than twenty miles in sixty years, or one-third of a mile per year; in Campbell County the advance has been but ten miles in fifty years, or one-fifth of a mile a year; while in Buckingham County there seems to have been scarcely any new territory covered for the last fifty years.

The progress of the disease cannot be considered at all regular, therefore, in some places it may reach four miles per year, while in others it may be five years in gaining a mile; but looking at the infected district as a whole, there has been, undeniably, a continual advance at a comparatively rapid rate.

Necessity for a closer study of the virus.—There are many problems, connected with this disease, which are still mysteries, but which it is extremely desirable should be cleared up. We are not yet certain as to the germ which is responsible for the trouble, and much less do we know anything of its habits of life and the means of destroying it. There is some reason why animals though exposed to the infection do not, as a rule, sicken until after the middle of July; this may be owing to the higher average temperature, but we are by no means certain.

The germs, at times, seem to be extremely sensitive to frost and cold weather, but in spite of this they somehow resist winters when the temperature sinks to zero. Is this because they descend in the soil so far that they are not exposed to this low temperature? Or is their apparent destruction by frost a mistake, and the cessation of the disease due entirely to the lower average temperature of the late fall, or to the fact that, the vegetation being killed by frost, the cattle no longer gather them up in sufficient quantity with their food?

There seems to be no doubt that this is a non-recurrent fever. Is it possible for us to learn enough of the conditions necessary for its production, and to so attenuate the virus that cattle exposed to it may be protected from its ravages by vaccination?

Finally, there are facts which indicate that pastures, even though permanently infected, if left to themselves, may be made safe in the future for the most susceptible animals; in other words, that by proper treatment the worst infected lands of the South may be freed from this virus. Is this true? Can the disease be not only checked in its advance but eradicated from the lands over which it has spread itself?

It may take years to solve these questions, but of what vast importance are they, not only to the country now infected, but to that which is becoming year by year more endangered. The first step towards this solution is evidently a thorough study of the virus; the determination if the diplococci which I have discovered in this virus are the essential agents of the disease, and, if so, a searching inquiry into their life history. Once make sure of the disease germ and the conditions under which the disease may be produced with certainty for experimental purposes, and the greatest obstacles to the investigation of this plague will be overcome.

Importance of determining the inoculability of the disease.—It has always been inconceivable to me how a disease could be disseminated by a something that could be transported hundreds of miles by animals and still be one that could not be produced by inoculation. In other words,

if the disease is produced spontaneously by animals taking something into their bodies with their food or with the inspired air, there is no apparent reason why it should not be produced experimentally by introducing the same essential cause by means of inoculation. And yet our best authorities had concluded that this disease could not be produced by inoculation.

Our ability to produce a disease experimentally is one of the first requisites to its successful study. It would have been impossible to demonstrate that charbon was caused by the *Bacillus anthracis*, or that fowl cholera was caused by a diplococcus, if the artificial introduction of these organisms into the bodies of susceptible animals had not produced these diseases. It would have been equally impossible to have discovered many other facts that have been brought out during the last three years, and which have done so much to clear up the mysteries connected with the contagious fevers.

And, so, if the inoculability of Texas fever had not been discovered and demonstrated during the last two summers, we should still be in the greatest doubt as to the possibility of determining the connection of the diplococcus of the spleen with the etiology of this plague. At present, however, it seems as though this would not be so very difficult. The disease may be produced by inoculation with splenic pulp; this is one point gained, and a most important one. The fresh splenic pulp contains a diplococcus and apparently no other organism; this is fact number two, and, for our purpose, scarcely less important than the other. It is true the cultivated diplococcus failed to produce the disease when inoculated in our experiments of last fall; but, as I have already shown, this may be explained by the unfavorable conditions under which the culture was made and used.

We have some established facts to work from in the future, and I shall be very much surprised if we are not able to prove that the diplococcus of the spleen is the true germ of the disease. When this is done, we can easily study its life history and the conditions necessary for its existence. We can change it into a vaccine if desirable, we can test the effect of disinfectants upon its development and existence, and, indeed, there are few points, connected with the disease, that cannot be discovered by a careful study of its exciting cause. What has been accomplished, therefore, must be looked upon as having an important bearing on the future investigations of this disease, and it may enable us, if our views in regard to this germ are well founded, to make as thorough a study of this plague as has been made of any other.

INVESTIGATIONS OF FOWL CHOLERA.

As there were a number of very important questions connected with fowl cholera which we were unable to dispose of in our former reports, for lack of experimental data, we have continued our investigations of this disease, and carried them as far as our time and facilities would permit.

Susceptibility of the offspring of insusceptible fowls.—There were many reasons why it seemed possible that the offspring of insusceptible fowls might inherit, if not complete immunity from the disease, at least a certain degree of insusceptibility, which would be indicated by the

effects of diluted virus. Pasteur had made some experiments upon this question, and concluded that no degree of immunity was inherited, though, in the published report of his experiments, we were left in doubt as to whether both parents were thoroughly protected by vaccination. Again, the chicks were inocculated with strong virus, which could only show that they had not acquired complete immunity, without giving any indication as to lesser degrees of this.

In the spring of 1882 I put a number of thoroughly vaccinated hens and a vaccinated cock in an inclosure, where they were completely isolated from other fowls. These were, from time to time, inoculated with strong virus to make sure that their immunity was not lost during the experiment. Their eggs were hatched, and the following experiment proves the susceptibility of the offspring:

Experiment No. 1.—Two chickens, five or six weeks old, the offspring of insusceptible fowls, were inoculated June 21 by a single lancet puncture with virus diluted 1 to 2,500. June 27, one has plain though slight lesion, the second has but a faint appearence of one. June 29, both have the local congestion, which demonstrates the multiplication of the virus. July 7, the lesion in each case is very much developed, though both remain well. July 13, the lesions have nearly disappeared; both in excellent health. This virus tested on other fowls at the same time, and in the same strength, produced no greater effect that on the chickens. We may conclude, therefore, that no appreciable degree of immunity can be conferred by fowls upon their offspring in this disease.

Effect of sterilized virus on susceptibility.—From the considerations which were discussed at sufficient length in my preceding report, it seemed that the immunity acquired, in regard to contagious diseases, from a first attack, must be due to the living matter of the body becoming inured to the chemical products formed by the disease germs during their multiplication. That it is not due to any chemical changes in the composition of the tissues, is sufficiently apparent from the fact that broth made from insusceptible fowls is still a perfect cultivation liquid for fowl cholera micrococci.

If we introduce a small number of these micrococci into the tissues of the most susceptible fowl they produce no effect whatever, as is seen in experiment number 7, where fowls inoculated with virus diluted as 1 to 125,000 did not develop even a local irritation, although in this case from ten to twenty micrococci must have been placed beneath the skin. This would indicate that, in the perfectly healthy tissues, the conditions are such that the bacteria cannot multiply. When we introduce a larger number of germs, there is a correspondingly increased quantity of the chemical products not only placed in the tissues at the time of the inoculation, but continually being formed. These products we know to be poisonous from their effects on fowls when injected beneath the skin in a concentrated condition and free from living organisms.

Referring the reader to my previous report for a complete theory of insusceptibility and its production, I will simply detail the experiments that have been made up to this time to throw more light upon this difficult question.

Experiment No. 2.—Nine fowls bought in the market May 25, 1882, were divided into four lots. Lots 1, 2, and 3 are of two fowls each, and receive hypodermic injections of cultivated virus sterilized by heat, and in case of the larger doses concentrated over a water bath. Lot No. 4 contains three fowls, and is preserved without treatment for comparison. The injections were made three times daily for twenty-two days, commencing with small doses, and gradually increasing until with lot

3 they reached what represented one ounce of cultivation liquid. The following table shows the hour and quantity of each dose:

Number of dose.	Day.	Hour.	Lot 1.	Lot 2.	Lot 3.
			Minims.	*Minims.*	*Minims.*
1	May 27	9.30 a. m.	1	4	8
2	May 27	1.30 p. m.	2	8	16
3	May 27	7.15 p. m.	3	12	24
4	May 28	9.00 a. m.	4	16	32
5	May 28	2.30 p. m.	5	20	40
6	May 28	7.00 p. m.	6	24	48
7	May 29	6.30 a. m.	7	28	56
8	May 29	2.00 p. m.	8	32	64
9	May 29	7.30 p. m.	9	36	72
10	May 30	8.00 a. m.	10	40	80
11	May 30	1.15 p. m.	11	44	88
12	May 30	7.30 p. m.	12	48	96
13	May 31	6.45 a. m.	13	52	104
14	May 31	1.30 p. m.	14	56	112
15	May 31	7.15 p. m.	15	60	120
16	June 1	7.30 a. m.	16	64	128
17	June 1	1.30 p. m.	17	68	136
18	June 1	7.30 p. m.	18	72	144
19	June 2	7.15 a. m.	19	76	152
20	June 2	1.30 p. m.	20	80	160
21	June 2	7.30 p. m.	21	84	168
22	June 3	7.45 a. m.	22	88	176
23	June 3	1.45 p. m.	23	92	184
24	June 3	7.00 p. m.	24	96	192
25	June 4	7.00 a. m.	25	100	200
26	June 4	3.15 p. m.	26	104	208
27	June 4	7.45 p. m.	27	108	216
28	June 5	7.30 a. m.	28	112	224
29	June 5	1.30 p. m.	29	116	232
30	June 5	7.30 p. m.	30	120	240
31	June 6	7.30 a. m.	31	124	248
32	June 6	1.15 p. m.	32	128	256
33	June 6	7.30 p. m.	33	132	264
34	June 7	7.30 a. m.	34	136	272
35	June 7	12.30 p. m.	35	140	280
36	June 7	7.45 p. m.	36	144	288
37	June 8	7.30 a. m.	37	148	296
38	June 8	1.30 p. m.	38	152	304
39	June 8	7.15 p. m.	39	156	312
40	June 9	7.30 a. m.	40	160	320
41	June 9	1.30 p. m.	41	164	328
42	June 9	7.30 p. m.	42	168	336
43	June 10	7.30 a. m.	43	172	344
44	June 10	1.30 p. m.	44	176	352
45	June 10	7.15 p. m.	45	180	360
46	June 11	8.00 a. m.	46	184	368
47	June 11	2.15 p. m.	47	188	376
48	June 11	7.30 p. m.	48	192	384
49	June 12	7.30 a. m.	49	196	392
50	June 12	1.30 p. m.	50	200	400
51	June 12	7.00 p. m.	51	204	408
52	June 13	7.30 a. m.	52	208	416
53	June 13	1.30 p. m.	53	212	424
54	June 13	7.30 p. m.	54	216	432
55	June 14	7.45 a. m.	55	220	440
56	June 14	12.45 p. m.	56	224	448
57	June 14	7.45 p. m.	57	228	456
58	June 15	7.30 a. m.	58	232	464
59	June 15	2.15 p. m.	59	236	472
60	June 15	7.30 p. m.	60	240	480
61	June 16	7.45 a. m.	60	240	480
62	June 16	1.45 p. m.	60	240	480
63	June 16	7.30 p. m.	60	240	480
64	June 17	7.30 a. m.	60	240	480
65	June 17	1.30 p. m.	60	240	480
66	June 17	7.50 p. m	60	240	480

The irritation produced by the substance injected seemed to be greater with lot 1 than with the others, though one of the fowls in lot 2 was severely affected. This irritation was most intense at about the fiftieth dose.

June 21, the fowls of lots 1, 2, and 4, and one of those in lot 3, were

inoculated with virus diluted 1 to 2,500; the second one, in lot 3, inoculated with a dilution of 1 to 50,000.

June 28, all the birds except No. 2, in lot 3, have marked irritation at the point of inoculation.

July 7, one in lot 2 is very sick, also one in lot 4. The bird inoculated with a dilution of 1 to 50,000 shows no results.

July 14, the sick fowl of lot 2 is dead; the others have recovered.

The birds subjected to treatment with the devitalized virus were, consequently, equally susceptible with those that received no treatment, and, therefore, under the conditions of this experiment devitalized virus is powerless to protect against the living germs.

In this experiment there was no satisfactory evidence that any immunity had been granted, and it was determined, for this reason, to repeat it with a larger number of fowls, and in case of the smaller doses to give these in full amount from the first. The duration of this experiment was two days greater than the last.

Experiment No. 3.—Twelve fowls were divided, July 7, into six lots of two each. Five of these lots received, three times daily, by hypodermic injection, doses of sterilized cultivation liquid, as follows: Lot 1, 5 minims; lot 2, 10 minims; lot 3, 15 minims; lot 4, 30 minims; lot 5 commenced with 5 minims and increased one minim each dose to one drachm, the remaining doses being of this quantity. Lot 6 received no treatment. The first dose was administered July 7, at 2.30 p. m.; the last dose July 31, at 6.30 p. m. They, consequently, received 72 doses.

August 5, each of the fowls in the abve six lots were inoculated with virus diluted 1 to 1,000.

August 15, all have the local lesion produced by inoculation.

None of these birds were sick, but the effect produced on the lot that received no treatment was no greater than on the others. No immunity was, therefore, conferred. The virus used in this experiment had become somewhat attenuated by standing, or some of the fowls would have certainly died from its effects.

Here, again, although the chemical products have been injected thrice daily for a time equal to that required to produce complete insusceptibility by vaccination, and although the dose was varied so as to be almost certain to cover the quantity that would be produced by the number of germs multiplying as a consequence of vaccination, our results are completely negative. Is our theory of insusceptibility wrong, or have we failed in some of the conditions necessary to its production? We have in view some experiments which will probably decide this important question.

Vaccinations with diluted virus.—Although the experiments, detailed in the preceding report, were sufficient to demonstrate that this virus might be diluted until when inoculated it no longer produced other effects than a slight local irritation, and that this irritation was sufficient to grant an immunity from the effects of the strongest virus in the future, there was still doubt as to how far this dilution might be carried and yet produce the local irritation, without which no degree of protection resulted. There was still doubt as to the proper dilutions to use for practically producing insusceptibility with safety. To obtain more definite results on this point, a number of experiments were made which are given below.

Experiment No. 4.—Four fowls, which had been previously inoculated with a dilution of 1 to 80,000, and of which two had shown a perceptible local irritation, were inoculated, February 22, with a dilution of 1 to

10,000; March 4, the two which resisted before have plain lesions; the others are not affected.

No bad effects followed this inoculation.

Experiment No. 5.—Three birds, which had been inoculated with a dilution of 1 to 40,000 without result, were again inoculated, February 22, with a dilution of 1 to 10,000.

March 4, two have the local lesion. The third one showed no effects from the inoculation; the others recovered without signs of sickness.

Experiment No. 6.—Two birds, that had been inoculated with virus diluted 1 to 20,000 without effect, were inoculated, February 22, with virus diluted 1 to 10,000.

March 1, one has slight lesion; the other has no appearance of one. March 11, both are sick; the 12th, one died, and one day later the second one died.

Experiment No. 7.—Three susceptible Plymouth Rock hens were inoculated, February 22, with virus diluted 1 to 125,000. The inoculation produced no effect whatever.

Experiment No. 8.—The three hens of experiment 7, and a cock of the same breed, not before inoculated, were inoculated, March 28, with virus diluted 1 to 100,000.

April 3, one has the local lesion; the 8th, a second has this lesion. The others were not affected.

Experiment No. 9.—The four fowls of experiment 8 were inoculated, April 24, with a dilution of 1 to 80,000. This produced no effect.

It was not possible to carry these experiments any further during the past year. The following table is a recapitulation of the results of all the inoculations with dilutions of the standard virus (see report for 1881). In nearly all the cases where the local lesion was produced the fowls were afterwards either tested with strong virus or were exposed to infected runs, and none have died from either of these tests. The figures in the column headed "Dilution" represent the number of parts of salt solution to each part of standard virus:

Dilution.	Number inoculated.	Local lesion.	Mild attack.	Death.	No effect.
1 to 50	1	1	....	....	....
500	1	1	....	....	....
1,000	16	12	....	4	....
2,500	15	11	....	4	....
5,000	3	2	....	1	....
10,000	25	16	2	6	1
20,000	4	....	....	2	2
40,000	4	....	....	1	3
50,000	1	....	....	....	1
80,000	6	2	....	....	4
100,000	4	2	....	....	2
125,000	3	....	....	....	3
Totals....	83	47	2	18	16

Taking these experiments, then, just as they have been made, and we find that 49 fowls out of 83 have been made insusceptible by inoculation with diluted virus, while only 18 have died; but these inoculations were made, not with the idea of producing immunity with safety, but to learn the effects of the virus diluted to different degrees. By inoculating with a dilution of 1 to 125,000 no effect is produced. A dilution of 1 to 80,000, or probably 1 to 60,000, might be used safely as a first inoculation, and with this the most susceptible birds would contract the lesion and obtain immunity. The remaining ones should, then, be inoculated

with a stronger virus, 1 to 40,000, or 1 to 20,000, perhaps; we are unable to decide exactly without testing it in this manner on a larger number of fowls. If any remain which resist a second time the virus should be gradually increased in strength until all have become insusceptible. How many different strengths of virus this would require in order to make the operation perfectly safe is still to be determined. The varying susceptibilities of fowls to this disease is the great obstacle which we have to encounter; but this must be overcome, as well, with any vaccine prepared by other methods.

The table may lead to some misapprehension in regard to the merits of this method, because from the different susceptibilities of the different lots of fowls operated upon there would appear to be as large a proportion of deaths with virus diluted as 1 to 20,000 as with that diluted as 1 to 10,000, or even as 1 to 1,000. With larger numbers of fowls this discrepancy would disappear. That the effects of the virus gradually lessens with the dilution is very evident on a little consideration. By inoculating with strong virus certainly two-thirds of the fowls would die, and probably a larger proportion, as this is the rate in using virulent blood, while the cultivated virus is much stronger. With a dilution of 1 to 10,000 but one-fourth die, while of 14 inoculated with a dilution of 1 to 50,000, or greater, none have died.

Of ten inoculated with dilutions of 1 to 80,000, or weaker, four, or two-fifths, contracted the local irritation and gained immunity, while the remainder were not affected. Of the 25 inoculated with a dilution of 1 to 10,000, six died and two had mild attacks; that is to say, the virus was too strong for eight. If the proportion should hold good, therefore, and these twenty-five had been first inoculated with a dilution of 1 to 80,000, the ten most susceptible ones would have been granted an immunity, and there would, consequently, have been no deaths when the remainder were inoculated with the dilution of 1 to 10,000. In this case all would have acquired an immunity with two inoculations. This is, perhaps, a more favorable case than we could always expect. I simply call attention to it to give an idea of how the method would work in actual practice.

Duration of the immunity.—It is important to know how long we can expect fowls to remain insusceptible, after they have become so by a mild attack by inoculation or vaccination. If the operation must be frequently performed, it would be too great a tax on animals of so little value. On the other hand, if nearly all should retain their immunity through life, the cost of the operation would be very trifling compared with losses from cholera, which in many sections almost entirely depopulates the poultry yards. Fowls, as a rule, are not kept after they are two or three years old, so that, even if inoculated when young, the duration of the immunity would not need to be very long.

People who recover from contagious diseases, or are vaccinated when young, frequently retain the immunity thus acquired during life; that is, in many cases, for 50 or 60 years. Cattle and sheep vaccinated for charbon have been shown to be completely insusceptible after eighteen months. With fowls my experiments have been very limited.

The following tests with strong virus were made March 1, 1882:

One hen that had been inoculated May 13, 1881, resisted perfectly.

One hen, frequently inoculated without success during the fall of 1880, resisted perfectly.

One hen, inoculated in the spring of 1881, had a very slight local irritation following this inoculation.

One hen, which had been several times inoculated with strong virus,

without success, during the winter and spring of 1881, contracted the disease and died.

One hen, which had an attack of cholera and recovered in August, 1880, resisted perfectly.

Two, inoculated in November, 1881, resisted perfectly.

Judging from the above experiments, the immunity will be retained in most cases a sufficient time to make one successful inoculation all that is required during the lifetime of a fowl.

TESTS OF DISINFECTANTS.—The effect of the different disinfectants upon the virus of the various contagious diseases has never been accurately determined. Until very recently there was scarcely any experimental data to guide us either in selecting a disinfectant or in deciding the strength of the solution in which it should be used. There has, consequently, been much doubt in regard to the efficiency of many of the agents formerly relied upon as disinfectants, and there has been even more doubt in regard to the strength in which these chemicals should be used to give satisfactory results. To give a more substantial basis for practical disinfection a number of experiments have been made which remove all doubt as to the efficiency of a certain number of disinfectants in fowl cholera, and show very clearly the strength in which they should be used.

EFFECT OF PLATT'S CHLORIDES.—A quantity of this disinfectant was furnished to me by the manufacturers, with the request that I should test it in any way that might be convenient. It is represented to be a saturated solution of the chlorides of magnesium, potassium, sodium, zinc, &c.

Experiment No. 11.—Two fowls were inoculated April 24, with virus that had been mixed, for fifteen minutes, with five times its volume of a dilution of Platt's chlorides as 1 to 5.

April 26. The tissues at the point of inoculation are cauterized by the strong chlorides introduced with the virus.

There were no symptoms of cholera as a result of this inoculation.

Experiment No. 12.—Two fowls were inoculated April 24, with virus that had been mixed, for fifteen minutes, with five times its volume of Platt's chlorides diluted as 1 to 10.

April 26. There is considerable irritation at the point of inoculation from the caustic nature of the disinfectant.

May 7. Yellow urates.

May 9. One dead.

The second was sick some days, but recovered.

Experiment No. 13.—Two fowls were inoculated April 24, with virus mixed, as in experiment 12, with Platt's chlorides diluted as 1 to 20.

April 26. The irritation produced by the disinfectant at the point of inoculation is less than in the two preceding experiments, but it is still noticeable.

May 7 and 8. Yellow urates and diarrhea; both sick.

May 13. The two birds have recovered, the attack being rather mild.

From these experiments we concluded that Platt's chlorides might be relied upon to destroy the virus of this disease in dilutions of 1 to 5, but that in greater dilutions it was without effect.

As there has recently been considerable discussion as to the value of the chlorides as disinfectants, and as these experiments might be considered too few to allow positive results, I determined to test the effect of this solution by laboratory methods.

Experiments Nos. 14 *to* 16.—To the sterilized cultivation liquid in three tubes was added, respectively, one-fourth, one-ninth, and one-fourteenth

of its volume of Platt's chlorides. A few drops of virus were then added and the apparatus allowed to stand for two hours. At the end of this time, two drops were taken from each tube and placed in the sterilized liquid of fresh tubes. It is plain that if the germs were destroyed by the disinfectant there would be no multiplication in the fresh tubes, while if they retained their vitality this would be very evident from their rapid development. The tubes were kept at 100° F. for twenty-four hours, when the germs that had been treated with the dilutions of 1 to 15 and 1 to 10 were found to have retained their vitality and multiplied at the usual rate, while those which had been in the solution of 1 to 5 had not multiplied and were evidently dead.

The laboratory test and the inoculation experiments coincide exactly, therefore, and the efficacy of the solution may be regarded as definitely determined, as far as regards this virus.

EFFECT OF SULPHURIC ACID.—It had been ascertained by inoculation experiments that a one-half per cent. solution of sulphuric acid very quickly destroys the activity of the virus in this disease. It was desirable to know if a weaker solution might be depended upon to produce the same effect. The following experiments are conclusive on this point:

Experiments Nos. 17 *and* 18.—To the sterilized liquids of two tubes was added sufficient sulphuric acid to make solutions of one-eighth and one-quarter of one per cent. A few drops of virus were then added, and after agitation allowed to stand for an hour and a half. At the end of this time two drops were taken from each tube and placed in a fresh cultivation apparatus. In twelve hours the germs had multiplied until the liquids in each tube were turbid.

Experiments Nos. 19 *and* 20.—After the virus, in the foregoing experiments, had been in the disinfectant for twenty-four hours, two drops were again taken from each tube and placed in a fresh cultivation apparatus. After twelve hours' cultivation it was evident that the germs had survived the twenty-four hours' treatment with one-eighth per cent. of the acid. It was only after thirty-six hours that a slight opalescence was seen in the second tube. The stronger solution had, therefore, destroyed most of the germs within the twenty-four hours, or, at least, had greatly enfeebled them. It is plain from this that the one-half per cent. solution of sulphuric acid is the weakest that can be used with safety.

EFFECT OF CARBOLIC ACID.—It was ascertained in previous experiments, by inoculation, that a 1 per cent. solution of carbolic acid very quickly destroyed the activity of this virus. Would the laboratory tests confirm this, and, if so, would a weaker solution prove equally effective? To determine this the following experiments were made:

Experiments Nos. 21 *to* 23.—The germs were placed in solutions of the strength of 1 per cent., three-fourths per cent. and one-half per cent., according to the same method as in the preceding experiments. After an hour and a half they were placed in cultivation tubes to test their vitality. Those which had been in the 1 per cent. and the three-fourths per cent. solutions were destroyed and unable to multiply, while those which had been in the one-half per cent. solution were still active.

Experiment No. 24.—After the virus had been in the one-half per cent. solution of carbolic acid for twenty-four hours, its vitality was again tested by cultivation. This time it was unable to multiply, and was evidently dead.

A three-fourths per cent. solution of carbolic acid is, then, sufficient

to destroy this virus within an hour or two, while a one-half per cent. solution will accomplish this within twenty-four hours.

EFFECT OF GLYCEROBORATE OF SODA.—A communication having been made to the French Academy of Science, in which this agent was recommended as a more efficient disinfectant than carbolic acid, and at the same time free from poisonous properties, I prepared some according to the formula given in that paper and tested it as below:

Experiments Nos. 25 and 26.—This virus was placed, as in the preceding experiments, for one and one-half and for twenty-four hours in a 1 per cent. solution of the glyceroborate. Its vitality was then tested by cultivation, and in each case it multiplied with its usual activity. The glyceroborate cannot be regarded, therefore, as a very efficient disinfectant.

EFFECT OF CHLOROFORM.—This agent is frequently useful in the laboratory for destroying germs in liquids that are afterwards to be examined for bacterial products, as it can be easily removed by distillation, thus leaving the original liquid free from any contamination with the disinfectant.

Experiments Nos. 27 to 29.—The living germs were placed for two hours in solutions containing 10 per cent., 3 per cent., and 1 per cent. of chloroform. Their vitality was then tested by cultivation. Those which had been in the 10 per cent. and the 3 per cent. solutions were unable to multiply, while those that had been in the 1 per cent. solution were still vigorous and apparently unaffected.

EFFECT OF CHROMIC ACID.—*Experiment No. 30.*—Virus was placed for two hours in a one-tenth per cent. solution of chromic acid. Its vitality was then tested by cultivation. It multiplied actively and rendered the liquid opalescent after the usual time. Chromic acid in this strength is not a disinfectant for this virus, although other observers have found it efficient with the virus of different diseases.

EFFECT OF IODINE.—*Experiments Nos. 31 to 33.*—The virus was placed in three solutions having respectively the strength of one-fifth, one-eighth, and one-tenth of 1 per cent. of iodine, and twice this quantity of iodide of potassium to cause solution. After two hours it was placed in cultivation tubes to test its vitality. In each of these cases the germs were destroyed by the disinfectant. In treating virulent blood with this disinfectant, it was found that a one-eighth per cent. solution no longer destroyed its activity when tested by inoculation. Is there a discrepancy here? I am inclined to think that the iodine caused a coagulation of the blood which protected the germs, in this case, from the action of the disinfectant. It is a point worthy of further investigation.

COMPARISON OF SOME RECENT STUDIES OF DISINFECTANTS.

The effect of disinfectants in solutions of a definite strength, and acting for a definite length of time, has recently received considerable attention. Koch, of Berlin, has studied the effect of these on the *Bacillus anthracis;* Arloing, Cornevin, and Thomas have studied the effect on the virus of *charbon symptomatique*, known in this country as *black leg* and *black quarter;* Sternberg has experimented with the *micrococcus septicus*, while my own experiments have been made with the micrococcus of fowl cholera. These investigations are giving us data which

place the subject of disinfection on a much more secure foundation than it has ever rested upon before, but there is still much to be desired. It will be instructive to compare the results of these different experiments, where they admit of it, but it must be borne in mind that the bacteria of anthrax and black quarter both form spores, and hence these viruses, particularly when dried, resist much stronger agents than do the micrococci.

BICHLORIDE OF MERCURY, OR CORROSIVE SUBLIMATE.—This is considered by Koch the disenfectant *par excellence.* It destroys spores even in solution of 1 to 20,000. Solutions of 1 to 5,000 to 1 to 1,000 are capable of destroying spores in a few minutes even when applied as spray. The solution of 1 to 5,000 destroys the virus of black quarter, either fresh or dried.

IODINE.—Saturated solutions destroy both charbon virus and the virus of black quarter when in a fresh condition. Solutions of one-fifth per cent. destroy the septicæmic virus; those of one-tenth per cent. fail to do this. The fowl cholera virus is destroyed by solutions of one-tenth per cent., which is as far as the tests have been carried.

CARBOLIC ACID.—Two per cent. solutions do not destroy the spores of anthrax; when of a strength of five per cent. it destroys them in two days. Its action is very energetic on the rods; when in the proportion of 1 to 850 it entirely prevents their development. Two per cent. solutions destroy the virus of black quarter whether dry or fresh, but require from eight to twenty hours. When in the proportion of one and one-fourth per cent. it destroys the *micrococcus septicus*, but fails when no stronger than one-half per cent. Solutions of three-fourths per cent. destroy the virus of fowl cholera in two hours, and those of one-half per cent. destroy it in twenty-four hours. In oil or alcohol, according to Koch, it loses its antiseptic qualities.

SULPHURIC ACID.—Destroys fresh black quarter virus in 5 per cent. solutions, and the virus of septicæmia and fowl cholera in one-half per cent. solutions.

SALICYLIC ACID.—Said to be without effect on anthrax virus; destroys black quarter virus in solutions of one-tenth per cent. It neutralizes septicæmic virus, when present, in 1¼ per cent., and fowl cholera virus at 1 per cent.

BORACIC ACID.—Without effect on anthrax virus; destroys that of black quarter in solutions of 5 per cent., and that of septicæmia in 2 per cent.

NITRIC ACID.—Destroys black quarter virus, when present, to the extent of 5 per cent., and septicæmic virus in one-fourth per cent.

NITRATE OF SILVER.—One-tenth per cent. destroys black quarter virus, either dry or fresh.

PERMANGANATE OF POTASH.—Five per cent. destroys either anthrax or fresh black quarter viruses, and 2 per cent. destroys septicæmic virus.

SULPHATE OF COPPER.—Twenty per cent. destroys virus of black quarter, dry or fresh; and one-fourth per cent. is sufficient with septicæmic virus.

SULPHATE OF IRON.—One-fourth per cent. destroyed the virus of septicæmia, but 20 per cent. failed with black quarter. The sulphates of iron and copper deserve more extensive investigation, especially as poisons for the micrococci.

HYDROCHLORIC ACID.—It requires 50 per cent. to destroy the virus of black quarter, while 2 per cent. destroys that of anthrax and one-half per cent. that of septicæmia.

CHLORIDE OF ZINC.—Is without effect on the spores of anthrax in 5 per cent. solutions, acting for a month; destroys septicæmic virus in solutions of 2½ per cent.

SULPHUROUS ACID GAS.—Destroys rods, but not dry spores of charbon, when present in the atmosphere, to the extent of 1 per cent.; is without effect on the virus of black quarter; according to Sternberg, 1 per cent. destroys vaccine virus.

BROMINE GAS.—This is one of the few agents, and the only gas, which destroys the virus of black quarter with certainty.

This list includes the most powerful disinfectants which have been discovered up to this time, and all of those which have been tested with more than one virus. It will be noticed that the micrococci of septicæmia and fowl cholera are destroyed with about the same strength of solution, while the two viruses which form spores resist much more concentrated disinfectants. There are many other agents to be tested, some of which have already been tried with one or the other of the contagia above referred to, and it is hoped that the near future will enable us to undertake the disinfection of buildings or grounds with a certainty that we will accomplish this in a reasonable time.

The method of testing disinfectants in the laboratory which I have perfected, and which so far has given results corresponding so exactly with inoculation experiments, will be of very great assistance in this class of studies. Formerly, we were obliged to make a considerable number of inoculation experiments before we could hit upon the exact strength of disinfectant necessary to destroy the virus in a given time. Now, the first trials can be made in cultivation tubes, and two or three inoculations, to confirm these, make our conclusions perfectly safe.

OUR ANIMAL PLAGUES AND THE MEANS OF CONTROLLING THEM.

Each year, as we sum up the investigations that we have made, and compare them with what has been accomplished by others who are working in the same field, we are confronted by the ever-recurring question: What practical means are at our disposal for controlling the plagues which annually produce such havoc among our different varieties of live stock? With none of these diseases have we any inter-State regulations for isolating, quarantining, destroying, or otherwise disposing of affected animals to prevent the dissemination of the contagion, and, with many of them, it is doubtful if such regulations ever will or can be practically enforced.

The annual destruction of our agricultural capital, however, from the ravages of contagious diseases reaches an enormous aggregate; it is increasing with the density of our population and the greater development of the live-stock industry; and it goes on from day to day, from month to month, and from year to year. We may shut our eyes to the loss; we may steadily refuse to acknowledge it; we may console ourselves with the thought that those who call our attention to it are alarmists and are seeking to advance their own interests, and yet, all the time, there is coming up a cry from every section of our country for assistance. The fowls are dying with cholera from the Atlantic to the Pacific, and from the British Possessions to the Gulf of Mexico; hog cholera has spread itself over the great pork producing regions of our country. Cattle are affected on the Atlantic seaboard with pleuro-pneumonia, at the South

with Texas fever; in the Southwest with charbon and Texas fever, and in all parts of our territory with black quarter, tuberculosis and enzoötic abortion. We even find the markets of the world closed, in some cases, against our pork products because of a real or fancied danger from trichiniasis.

Until recently, there has been but little known, even by the veterinary profession, of the nature of these diseases or of any satisfactory methods of controlling them; but the last half-dozen years has added so much to our knowledge, and has so materially modified the views of scientists in regard to available means of prevention, that it seems desirable, in this report, to make a brief review of those plagues which are doing the most damage and which are most worthy of Governmental consideration.

PREVENTION OF FOWL CHOLERA.

If we examine the reports received each year at this Department, from the different parts of the country, we find that chicken cholera is mentioned as being destructive to the fowls in more than half of the counties heard from. The losses are estimated all the way from a few hundred dollars to as high as two hundred thousand dollars in single counties, and, if we consider that the remaining counties are affected to an equal extent, it is not difficult to realize the immense amount of capital that is annually swept out of existence by this plague. It may be that ten millions of dollars would cover the annual loss, but it is about as likely to reach fifteen or twenty millions.

The germs of this disease enter the system by the digestive organs, and they are generally taken with the food. The contagion is spread by means of the excrement of sick fowls or the flesh or other parts of dead ones. Frequently, no, doubt, it is carried considerable distances by small birds which are also subject to it.

If the feeding places and runs are kept free from these germs, there is no danger of the fowls ever becoming affected. Of course this could be accomplished by a daily sprinkling with a disinfectant, but this would be entirely too expensive a method to be practical, even in large poultry establishments. The most that we can expect is that when cholera is in a section the poultry-owners will watch their fowls, and, in case of sickness, at once remove the affected birds from the flock. The feeding grounds and houses should then be sprinkled with the disinfectant (sulphuric acid 8 ounces, water 8 gallons), and the probability is that no more deaths will occur until the contagion is again introduced from abroad.

There are many cases, however, in which the runs are thoroughly infected and remain so from year to year. Under such circumstances, the poultry houses must be thoroughly cleaned throughout, and the woodwork and floors completely saturated with the disinfectant. Runs must be fenced off for the fowls and these inclosures thoroughly sprinkled. On a small scale this may be done with a watering pot, and on a larger one with a cask or barrel mounted on wheels, as with street sprinklers. The disinfectant costs very little, even when several barrels of it are made; it is thoroughly reliable, and, consequently, by proceeding in this way poultry can be raised with the greatest safety, as far as this disease is concerned.

There are people, however, who, from a disinclination to try anything new that requires either expense or exertion, will not watch their fowls or disinfect the houses and feeding places. My experience with farmers leads me to conclude that this class comprises the great majority of

poultry-raisers, and that, consequently, although we have a very perfect remedy for chicken cholera, it has not been and probably will never be generally adopted. The average farmer wants something different; he is willing to try a remedy, but he is not willing to repeat it very often. If an animal is sick, he thinks one dose of medicine should cure it; and so, to prevent fowl cholera, he will work for a few hours, or go to a slight expense, but this must be the end of it; he will not trouble himself about the fowls again for a year, if he can possibly avoid it.

This being the fact, and I doubt if any one who attempts to introduce disinfection and close attention will ever contest it, it is perfectly apparent that there is but one way of controlling this destructive scourge. The fowls must be made insusceptible to it; they must be granted an immunity from the effects of the contagion; they must be enabled to run upon infected grounds and to eat food soiled with the active germs of the disease and not suffer from it. Very well; this condition, difficult as it would have appeared no longer than three years ago, is perfectly feasible at this time, thanks to the discoveries made within so short a period. We can change the virus into a vaccine, and at a comparatively small expense we can grant our fowls an immunity from this disease. There are even a number of methods by which this can be done, each of which is sufficiently perfect at the present time to be practical, but all of which will doubtless be improved when tested upon a larger scale. The choice between them also depends upon their practical working when used upon thousands or tens of thousands of fowls. How this virus or vaccine can be made and distributed so as to reach the consumer in a reliable condition, will be considered in a succeeding paragraph.

What we wish to insist upon is that the investigations of this disease have thrown so much light upon its nature, and the manner of its spread, that we are able to control it in a very satisfactory manner. We have not found a medicine that will cure a diseased fowl, and possibly never shall, but we have discovered something infinitely better and more useful—an approximately perfect preventive.

PREVENTION OF HOG CHOLERA, OR SWINE PLAGUE.

This disease is still very prevalent. A large majority of the counties in some States suffered from its ravages in 1880, and we have no reason to believe that the losses from it have diminished in any degree since that year. The investigations of this Department, which have been carried on for a number of years, have shown that its extension was due to contagion; they have enumerated the symptoms and pointed out the diseased organs; they have even indicated the bacterial parasite which is responsible for originating the plague. This is much—it is far more than the most sanguine veterinarian could have reasonably expected to see accomplished in so short a time. Still we lack something. We know our enemy, but we have not conquered him. The mortality from this pest continues unabated; and until we have introduced some effectual means of controlling this, the great practical end of these investigations has not been reached.

In what direction shall we look for this much desired remedy? Can we disinfect the great hog pastures of the West and South? Can we reasonably hope in our present circumstances to quarantine or destroy the thousands of diseased animals now annually to be found in our various States? No, indeed; the thing is plainly impossible. The demonstration of the contagiousness of the disease has enabled our agricultur-

ists to do something to prevent its spread; but without organized efforts the individual farmer is practically at the mercy of the disease.

Our investigations have shown that the plague is a non-recurrent fever, and that the germs might be cultivated; they have even proved that these germs may be made to lose their virulent qualities and produce a mild affection. Surely, we have here sufficient evidence to show that a reliable vaccine might be easily prepared, if we carried our investigations but a little way farther. If we had such a vaccine, if it were furnished in sufficient quantities and of a reliable strength, if it proved safe in the hands of the farmer, would not our problem be solved? Could we reasonably expect anything more or better for this disease?

M. Pasteur * has recently confirmed our American investigations in a very complete manner. He shows that the disease is produced by a micrococcus, that it is non-recurrent, that the virus may be attenuated and protect from subsequent attacks, and he promises a vaccine by spring.

This should certainly inspire our people with confidence, and it should incite our authorities to give the suffering pork-producers the full benefit of these discoveries at the earliest possible moment. There may be objections to vaccination, and I doubt not these are of a certain importance, but, with hog cholera already distributed over our whole hog-raising territory, these can have but little weight compared with the incalculable benefit that would be conferred by a practicable system of vaccination.

PREVENTION OF TEXAS FEVER.

With Texas fever we have a number of exceedingly difficult problems to solve. The conditions, in this case, are very different from those connected with either fowl cholera or swine plague. With this disease we have an infected and an uninfected part of the country, between which a very definite line may be drawn. The question of greatest importance in this case is to stop the encroachment of the infection upon the previously healthy country. Before this can be accomplished, the border line of the infected district must be traced from the Atlantic coast of Virginia to its southwestern terminus. During the past summer we succeeded in locating nearly two hundred miles of this line in the State of Virginia. At present, it appears as though there would be at least another hundred miles of this line to trace before we can feel certain of the distribution of the infection in this one State. Through North Carolina, South Carolina, and Georgia we already know the location of the greater part of this line with sufficient accuracy. From this westward, however, we are in the greatest doubt, and it will be necessary to examine almost every mile until we are across the Mississippi Valley.

That the disease is advancing toward the North with comparatively rapid strides, in the district so far examined, can no longer be contested. Is this equally true in the Mississippi Valley? And, if so, what is the rate of progress towards the great cattle regions of Kentucky, Illinois, Iowa, Missouri, and Kansas? And how many miles must still be crossed before these regions are invaded? What significant questions are these for one of our greatest agricultural industries; and, yet, who has thought of them, who knows their import, who has any definite knowledge of the situation!

When the infected district is once accurately outlined, the work may

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* L. PASTEUR: Sur le rouget, ou mal rouge des porcs. *Comptes Rendus*, xcv., p. 1120.

be begun with intelligence and system. There must be laws that will absolutely prevent the driving of cattle from the infected to the uninfected sections, except during the months of December and January. It is probable that cattle may be carried for slaughter over fenced railroads without danger. In the East, this law will not be a matter of inconvenience to any one except the petty cattle dealers of Virginia, who buy stock cattle in the infected parts and represent them to their customers as coming from uninfected counties. It is these unscrupulous men who are responsible for much of the loss which annually occurs, and they are about the only class of people who are not anxious for legislation regulating this traffic and protecting the healthy stock of the State. Fat cattle shipped or driven to market would not be troubled, as the greater part of these go to the boats at Richmond, West Point, or Norfolk; and all these points being within the infected district no harm could possibly be done. In the West, too, I have no doubt but that arrangements could be perfected which would completely protect the country, and at the same time allow all necessary movement of cattle.

Besides the movement of cattle referred to in the preceding paragraph, there is another kind of movement which it is of equal importance to regulate. I refer to cattle running at large in the roads, commons, and woods along the border line of the infected district, and for ten or fifteen miles on each side of it. Such commons are always first infected, and it is by means of them that the infection is so gradually and surely advancing. If what is known in the South as the "fence law" could be rigidly enforced in each of the counties bordering on the infected district, it would probably do more than anything else to check this advance, and, in the opinion of many who live in this section, it would cause the infection to die out in most of the recently-infected counties. Such a law is already in force in many parts of the South, though with no idea of combating this disease, and is regarded as the greatest boon ever conferred on the agriculturists of those sections. The enforcement of such a law, along the line of infection, to arrest the progress of the disease, would then be a benefit rather than an injury, even to those most directly interested. That such a law would be practical and effectual is believed by many of the most intelligent and best-informed gentlemen who have had experience with this plague.

Controlling the movement of cattle in this narrow belt of country would not only stop the encroachment of the infected district, but it would at once put an end to the greater part of those annual losses which are becoming, year by year, more widespread and more disheartening. The losses of cattle in this belt are for the most part due to their pasturing on infected roads and commons, and if the cattle in this district were kept on fenced pastures the losses would stop. Again, the outbreaks north and west of the line are always caused by cattle which have been brought across it, and hence stopping this movement effectually removes the danger. By these measures, then, the most important indications would be met, and the greater part of the losses would be stopped.

There are, however, three classes of losses, of less national importance, it is true, but still of great magnitude, which would not be affected and which cannot well be controlled by legislation. It is a fact brought out by the investigations of the past year that it is dangerous to move cattle in summer, even from one part of the infected region to another part of it; and this is particularly true in moving them from a recently-infected section to one that has been longer infected. Why this is so,

we are not yet in a position to judge, but that the deaths are frequent which follow the moving of cattle for only a few miles, or even from one field to another, we are very certain from a considerable number of cases reported to us from various sections.

A second and very serious loss occurs from shipping fat cattle from just outside of the infected district to the markets of Charleston, Savannah, Mobile, and other large cities of the South, even in winter. Fat cattle are very subject to this disease, and the loss to shippers and butchers is very severe. Again, it is asserted that many cattle affected with Texas fever are killed and their flesh sold as food in these markets, and, consequently, the local boards of health feel inclined to entirely prohibit the entrance of such cattle within their jurisdiction. Such a restriction necessarily acts as a double hardship. It prevents the people of these cities from obtaining the only really good and well-fatted beef that ever comes to them, and it withdraws the best markets that have heretofore been open to the cattle-raisers of a large section of country.

The third class to which I refer is the thoroughbred cattle imported into the South as a means of improving the native animals of this great section. No matter to what part of the infected district they are taken, whether to Eastern or Southern Virginia, to Middle North Carolina, to the greater part of Georgia, Alabama, Mississippi, Louisiana, Arkansas, or Texas, the most of them pay the penalty by dying of Texas fever within the first two years, and the remainder are never safe from its attacks. These deaths have been generally attributed, erroneously, to the effect of change of climate, to the character of the food, to the heat of the sun, and to various other conditions of life; but it results clearly from my observations that, in the immense majority of instances, they are due to Texas fever and nothing else. The acclimatization, so called, is the immunity, more or less complete, which the survivors of these cattle acquire as the result of a mild attack. This class of losses reaches a very large aggregate each year, because the animals are thoroughbred and of great value. I have known of the deaths of a number of animals valued at over one thousand dollars each. And, finally, the indirect loss arising from the discouragement to the development of the cattle industry in this enormous territory is something incalculable.

How such losses are to be prevented in the future is a problem that can only be decided by a complete scientific investigation of this disease. If the cattle which are comprised in the three classes under consideration could be easily and safely vaccinated with an attenuated virus, and thus protected from future attacks, the difficulty would be, in a great measure, removed. It must, therefore, be one of the great objects of these investigations in the future to reach definite conclusions on this important matter.

The feeding of astringent mixtures to susceptible animals which run on infected pastures is believed by many to be a sure preventive of the disease; others do not regard the practice as of any special benefit. If, however, the germs are taken into the system, as usually occurs with charbon, by way of abrasions of the mucous membranes of the mouth and pharynx, caused while eating dry, woody grasses, it is possible that such remedies may have a certain effect. But, while they may change the character of the wounds which they reach in such a manner as to prevent the inoculation of these with germs, it is evident that fresh wounds are continually liable to occur when grazing, and there would be many chances of infection which could not be guarded against in this way. Whether such agents have any protective effect whatever

is still an open question, but it is one which it seems to me is worthy of some investigation.

Ruffin's mixture has long enjoyed considerable popularity. It is composed of the following substances:

Salt, $\frac{1}{2}$ gallon.
Sulphur, $\frac{1}{2}$ pint.
Saltpeter, $\frac{1}{2}$ pint.
Copperas, $\frac{1}{2}$ gill.

These are well mixed together and kept, instead of common salt, always within the reach of the cattle.

Other people use lime, sulphur, and salt, and still others red clay, salt, sulphur, and saltpeter.

I will add a few words to these considerations for the benefit of the sufferers in a large belt of territory near the infected district, who have not heretofore understood the nature of this disease or the cause of its ravages. Every outbreak of the plague has been traced, though sometimes with much trouble, to the infection of the roads or pastures by cattle from an infected district. The safety of the stock, in this section, depends upon its being rigidly kept upon well-fenced pastures, to which no strange cattle can ever gain entrance. Thus fenced and secluded, it is safe, but allowed to run for only a single hour upon the dangerous roads and commons, between April and November, and all may be lost. If cattle must be purchased from the infected district, or from uncertain sources, they should only be brought to the farm in December or January. Movements may sometimes be made with safety in November and February, but this is not always the case, and the prudent farmer will under no circumstances incur the risk. With these precautions hundreds of thousands of dollars might be saved annually by the cattle-owners in the territory referred to.

PREVENTION OF PLEURO-PNEUMONIA.

The management of this disease requires more careful consideration than does that of any other plague which affects our live stock. Although the district already overrun is large, and the losses from its ravages amount to a considerable sum, they are so insignificant as compared with the vast areas and the enormous herds of the South and West, which are endangered by its presence on this side of the Atlantic, that we must of necessity base our action rather upon the welfare of the latter than upon the sufferings of the former. There can be no doubt, then, that this disease should receive immediate attention, and that the only object kept in view should be its complete extinction by the most summary measures at our command. The work is one which should be placed in the hands of a commission of undoubted ability and of sterling integrity, for both qualities will be needed and tested to the utmost before satisfactory results are reached.

We can recommend no temporizing measures in regard to this affection; the only ones applicable are quarantine, restriction of the movement of cattle, slaughter of affected animals, and disinfection. The details for this work have been so often insisted upon, and so thoroughly discussed in recent publications by Professor Law, that it is not neccessary for me at present to consider them. We may feel assured, however, that with laws giving the power to inspect, buy, and destroy cattle, and to control the movements of these animals at discretion, there would be no serious difficulty in freeing our country from this destructive plague.

From the standpoint of the investigator, there are two points which it seems important to mention in this place. The virus of this disease needs to be studied more carefully with a view to disinfection. We ought to know how to destroy the virus which has accumulated in a stable in the most thorough manner and in the shortest possible time. As it is, we know nothing definite of the action of disinfectants on the virus of this disease, and our attempts to disinfect buildings or grounds are far from certain or satisfactory on this account.

Again, the virus of pleuro-pneumonia should be more carefully investigated, in order to determine if it is possible to obtain a true vaccine from it—one that might be used to protect cattle from the disease, without danger to susceptible animals. It may not be particularly important just at this time to have such a vaccine, but with so much of the disease in this country it is liable at any time to be carried to the open pastures of the West, and in such a case a safe vaccine would be worth millions of dollars to us. At present it seems that such a vaccine would not be an impossibility, and hence it is worthy of a thorough investigation.

PREVENTION OF CHARBON AND BLACK QUARTER.

These two diseases, formerly supposed to be but different manifestations of the same affection, are now known to be entirely distinct, and are caused by two very different bacterial parasites. They depend more upon the nature of the soil than most other contagious diseases, and consequently the outbreaks are confined, as a rule, to a single farm or to a restricted area of country, though there have been notable exceptions to this. We occasionally hear of a disease in the New England or Middle States which is supposed to be charbon, but generally such accounts come from the West, and more particularly from the southern part of the Mississippi Valley. Undoubtedly there has been much charbon on these rich alluvial lands after the frequent inundations to which they are subjected; but we have no data for estimating either the extent of the infected districts or the value of the animals that have been lost.

Black quarter and black leg is a disease that appears to be much more frequent, and occurs in all parts of the country. The number of animals which die from it is evidently very large, and their value must therefore be considerable.

I have already discussed at considerable length the method of vaccination for charbon and that of inoculation for black quarter, which are now being practiced in France. Both could probably be greatly improved upon and rendered more suitable to our conditions. So scattered are these diseases in our country that a general system of vaccination for them, as is practiced in France, could never be advisable. But wherever there is a farm (and there are undoubtedly many such) where the disease returns from year to year and destroys numbers of animals, it would be proper to use a vaccine and protect the stock from it in the future. Indeed, this seems to be the only means of protection which we are able to extend to the majority of our farmers in the present condition of science.

PREVENTION OF TUBERCULOSIS.

This disease may develop in almost all of our domesticated animals, and, as is well known, it is one of the worst scourges affecting the human race. It is most frequently met with in cattle, and particularly in

milch cows. Where large herds are kept in stables, as is the case in the vicinity of all of our large cities, the conditions are most favorable to its propagation, and when once introduced into such stables it frequently attacks a large proportion of the cows that are in them. While inspecting the cow stables of New York City for pleuro-pneumonia, many cases of this kind came under my observation. In one stable, very well ventilated, clean, and comfortable, as far as I could see, where the cows were even allowed to spend the greater part of the day on the pastures, twenty-four out of thirty-one animals were plainly affected with this disease.

It is not entirely confined to stabled cows, however, for I have frequently observed infected herds in country districts, the progress of the disease and the intensity of its effects varying but little from what is seen in cities. Still, my impression is, that it is much less common in the country than among the stabled cows of cities.

The interest in this disease is at present greater than in any other, perhaps, because of the supposed discovery of a bacterial parasite, which may be cultivated and will produce the disease when inoculated. Nor can this interest be too great, for, in the past, this disease has been strangely neglected, notwithstanding the fact that about one hundred and fifty thousand of our people, and probably some millions of dollars worth of animals, annually succumb to it.

Whether the discovery of Koch is confirmed by future investigations or not, it seems to me that there is not a shadow of doubt that this is an inoculable and contagious disease, due to a virus just as specific in its characters as is the virus of chicken cholera, hog cholera, anthrax, black quarter, or pleuro-pneumonia. There have been many doubts thrown upon this view, particularly by English and American investigators, whose researches have, as a rule, been confined to very narrow grooves, and who have completely ignored the experiments of some of the most able scientists of our time. Starting with the unjustifiable and illogical assumption that tubercle is a specific lesion, and can only be produced in one way, they have gone on to show that non-specific inflammations induced by irritation may produce granulations which are anatomically and histologically identical with spontaneous tuberculosis. From this it was not a long stride to the conclusion that tubercles always arise from non-specific inflammations, particularly of the serous membranes.

After a long series of researches, one of our American scientists very recently reaches the conclusion that "The natural history of tuberculosis, just narrated, is surely against the existence of a special poison, such as now offered again by Koch. It is clearly proved that no infective agent is required to produce tuberculosis." Again, we are told that "In non-scrofulous animals, viz., other than rabbits and guinea-pigs, neither Robinson, nor Wood and myself, nor any other experimenter, ever succeeded in producing tuberculosis by inoculation, unless done into peritoneum or anterior chamber of the eye. No one, including Koch, ever produced tuberculosis, in animals not predisposed to it, by inoculations into the skin for instance."*

The numerous experiments of both Chauveau and Toussaint are strangely ignored in the above discussion, just as they must always be where such conclusions are reached. How can any one explain the eleven experiments of Chauveau, in which tuberculosis was invariably

*H. F. FORMAD, B. M., M. D.: The Bacillus Tuberculosis, &c. *Studies from the Pathological Laboratory of the University of Pennsylvania*, No. XI, pp. 9 and 10.

produced in calves by the ingestion of even small quantities of tuberculous matter with the food? How explain the intravascular injections of tubercular material with calves, horses, and asses, which were equally successful? And how, above all, the successful inoculation experiments of the same author made with calves, horses, asses, and mules by inoculations into the subcutaneous connective tissue and even into the skin itself.*

Then there are the numerous experiments of Toussaint—over two hundred, as he assures us—in some of which he has invariably produced tuberculosis in pigs by feeding tuberculous matter, or by inoculations into the subcutaneous connective tissue with tissue-juices, or even the blood of diseased animals.†

Surely such experiments cannot be dismissed as unworthy of consideration. The experiments of Chauveau and Toussaint also throw much light on the tubercles produced by non-specific inflammations. These are really but false tubercles, and inoculations with them never induce tuberculosis. Such a fact should be enough to satisfy the most exacting that there is an essential difference between the two classes of lesions, no matter how similar they may appear to the histologist.

It is not my purpose to discuss this highly important question at greater length in this report. My object is simply to call attention to the disease as one worthy of immediate attention in the investigations of this Department. If tuberculosis is a contagious disease, and generally produced by contagion, then it follows, as a consequence, that it can be prevented by the measures applicable to other similar plagues. The isolation or destruction of diseased animals and disinfection would undoubtedly accomplish much. It is for the investigations of the future, however, to decide what disinfectant can be safely used, and how long and in what strength it must be applied to be effectual.

PREVENTION OF THE ENZOÖTIC ABORTION OF DAIRY COWS.

This disease, which evidently depends upon some form of contagion for its causation, has been estimated to produce an annual loss, in the State of New York alone, of several millions of dollars. At present the affection is widely distributed over the country, and if the estimates in regard to New York were not greatly exaggerated, the annual loss from this source must be equal to or greater than from any other disease. The dairymen have settled down to the conclusion that nothing can be done to check this scourge, and they dislike so much to have its presence in their dairies known that the public hears little in regard to it.

If, as seems likely from our general knowledge of the contagia, the germs of this disease are first scattered upon the stable-floors and upon the grounds where the cattle run, to be taken into the system by soiled food, by the dust which rises and floats in the air, or in some similar way; then a thorough and continuous disinfection of the stables and runs should have a very marked effect in controlling it. In one rather large and plainly infected herd I have put this idea into practice with the happiest results—the disinfectant being a 1 per cent. solution of sulphuric acid.

It is very desirable that this trouble should be thoroughly investigated, with a view of revealing its cause and the best disinfectants that

* *Recueil de Médecine Vétérinaire*, 1872, p. 337.
† *Comptes Rendus*, xc, p. 754, and xciii, p. 281.

are applicable in its treatment. There certainly is no disease of our domesticated animals in which the probabilities are better for valuable practical results.

PREVENTION OF TRICHINOSIS.

This affection, which has served as a pretext for shutting out American pork products from the markets of various European countries, deserves more attention at our hands than it has so far received. Is it true, that with every one thousand hogs examined there will be found ten or fifteen times as many of the American animals infested with this parasite as of those in European countries? If this is the case, why is it that our hogs are infected in so much greater proportion? And by what means can we lessen this infection? Surely these are questions which should be thoroughly investigated.

In the mean time, what can we do to make our pork safe for even those consumers who insist upon eating it uncooked? Are the recent French investigations reliable, from which it has been concluded that, in the vast majority of cases, the trichinæ of well-salted meats are dead, and, therefore, incapable of doing harm? Or, can we easily and cheaply render all of our pork products perfectly safe by freezing, as seems to have been demonstrated by other investigations? If this happens to be the case, we could send any variety of pork products abroad and guarantee it absolutely free from living trichinæ. In years when the over-production is as great as sometimes happens, our ability to do this would be a matter of great importance to us.

WHY THE DEPARTMENT OF AGRICULTURE SHOULD FURNISH VACCINE FOR CONTAGIOUS DISEASES.

From the short review of our animal plagues, and the means of controlling them which is made above, it becomes apparent that we have four contagious diseases, widely disseminated over the country, which may, as it would appear, be prevented by any safe method of vaccination. There are a number of methods of preparing vaccine and of performing the operation, but which of them should be recommended by this Department can only be decided after a very extensive series of experiments. And such experiments can only be made by the Government because of the expense connected with them.

Suppose, however, we have decided that, for example, the method of Pasteur is, all things considered, the best for us to adopt. Suppose we say to our farmers all over the country that they can prevent chicken cholera, and hog cholera, and anthrax, and black leg by using a vaccine that is made according to the directions of this eminent scientist. Can we possibly expect any practical results to follow such an announcement? No, indeed; because no one can vaccinate against these diseases unless they are supplied with the vaccine. And this is so difficult to make that, outside of Pasteur's laboratory, no experiments in the production and use of it have been published as successful, up to this time, with the single exception of my own. We can hardly expect this vaccine to be supplied in a reliable form by any individuals, therefore; and, as in all cases, it seems to deteriorate within a few weeks after it is made, we cannot draw our supplies from M. Pasteur's laboratory with any confidence of satisfactory results.

There is, consequently, but one course open to us if we desire any

practical results from these recent and valuable discoveries: the Department of Agriculture must establish a laboratory to which the people can apply at any time, and be certain of receiving fresh and reliable vaccine.

It may be that in the near future it will be possible to protect our animals from Texas fever by vaccination, and, if so, this would be an additional work for such a laboratory to carry on. If the system should be generally adopted, however, the diseases which I have mentioned, and to which prevention by vaccination seems to be more particularly applicable, would give ample employment to a larger force than is likely to be devoted to it for some years.

At present we need such a laboratory for making vaccine for our own experiments with the different methods, and for working out the many practical details which are necessarily connected with any method that should be adopted and carried forward on so large a scale as this must be to meet the demands of our extensive territory. This can only be accomplished in a laboratory fitted up for this special work, and hence these discoveries can never be made practical until the Department provides such facilities.

To sum the whole matter up in a few words, the investigations of the last few years have made it perfectly apparent that our animal plagues are due to bacterial parasites; that these, with some of the most important diseases, are widely disseminated, and can only be combated by making our animals insusceptible to them; that all animals, even the most vigorous and the best cared for, are susceptible until they have had a mild attack, which alone seems sufficient to grant them immunity. The tendency of all recent research has been to produce such a mild attack by means of attenuated virus, and to thus put the animals in a position to encounter the most virulent germs without danger. To adopt this method of prevention we must have the prepared virus, and to get reliable virus at a reasonable expense there seems no other way than for the Department of Agriculture to furnish it, as it now does many varieties of seeds.

NECESSITY OF FURTHER INVESTIGATIONS.

I have endeavored to make it a prominent feature of this report to show that these investigations should not stop short of practical results; such results are now almost within our grasp, and to obtain the benefits of them we have only to give a slightly different turn to our methods of work. So far the investigations have been in many respects superficial; we have been feeling our way that we might learn what ought to be done and what could be accomplished. We should now fill up the gaps that are left by a thorough investigation of all the details and all the principles involved. Our recommendations can then be safely made, because they will be derived from a basis of experimental evidence that is perfectly reliable, and the indications of which cannot be mistaken.

Investigation of the nature and characters of virus.—In fowl cholera, anthrax, and black quarter the virus has already been quite thoroughly studied. With hog cholera we can scarcely have any doubt as to the form of parasite, but we know almost nothing of its natural history or the conditions necessary for its existence. With Texas fever we are still without any definite and satisfactory information, even in regard to the essential cause, though it is probable that this was discovered in the investigations of the past summer. In regard to the virus of pleuro-

pneumonia, tuberculosis, and enzoötic abortion, we have almost no knowledge whatever. The first step in the study of this class of diseases being the isolation and cultivation of the contagious germs, it is absolutely essential for us to continue this line of research.

The study of disinfectants.—This becomes possible when we have found the virus and are able to produce a disease by inoculation. We can determine the exact effect of any disinfectant in any strength and acting for any length of time by placing the germs in the solutions, with which tubes are filled, and afterwards transferring them to the fresh liquid in a cultivation apparatus. After definite results are obtained in this way they can be confirmed and rendered free from doubt by inoculation experiments. At this time we are far from knowing what disinfectants are most effectual in the different diseases which we have to contend with. A single point recently brought out by both German and French investigators shows how important this matter is. Carbolic acid has long been considered our most available disinfectant in many diseases. It has sometimes been used dissolved in water, sometimes in oil, and sometimes in alcohol. Now, the investigations to which I refer show that the aqueous solution is alone disinfectant, and that when dissolved in oil or alcohol it becomes harmless to disease germs. This is only one of very many similar details which must be elucidated before we are in a position to grapple successfully with our animal plagues.

Experiments in regard to the treatment of sick animals.—The treatment of sick animals or of people suffering from contagious diseases has never been satisfactory. Why this is so we are hardly in a position to judge, but it seems to be partly, at least, because our ideas as to what is to be accomplished are radically wrong. There are, however, so many cases in which medical treatment, even with animals, is very desirable, and the effect of any real discoveries in regard to treatment would be productive of so much good to the human species, that it seems to me we can hardly lose sight of this line of investigation when the opportunity occurs for its study. A combination of stimulants and disinfectants seems to promise the best results, but these can be selected only after a thorough study of their peculiar properties. Such studies, it is needless to say, are yet for the most part to be accomplished.

Experiments to decide as to the best method of attenuating virus.—Having already discussed this matter at considerable length, I only mention it here to complete this section of my report. Researches of this kind must be made before our farmers can obtain any practical benefit from the recent discovery of the possibility of generalizing vaccination.

Researches to discover methods of vaccination applicable to hog cholera and Texas fever.—These two diseases are, perhaps, the most important that we have to contend with. Vaccination is plainly indicated with both of them if it can be made practical. It must, consequently, be one of the primary objects of future investigations to develop this line of inquiry in a most thorough and comprehensive manner.

Investigations to learn the present distribution of Texas fever.—This work has not yet been completed in Virginia. There is probably a hundred miles of the border line of infection still to locate. It is essential that this sanitary survey should be completed before the State of Virginia can enact effectual laws to check the extension of this plague. Such laws are extremely desirable, as the most important advance of the disease in the Eastern States is occuring here. The people of Virginia are extremely anxious for such laws for their own protection, and when they have sufficient information to allow these to be framed in-

telligently, I have no doubt but that prompt action will be taken in regard to this important matter.

As to the distribution of this disease in the States of Tennessee and Arkansas, we are almost in complete ignorance. I have some facts which indicate that it is gaining a foothold in Missouri, but I refrain from more than mentioning them, because they are too indefinite. It is sufficiently evident, I think, that this line should be at once traced across the Mississippi Valley, in order that the Western States may adopt timely measures to protect their enormous cattle interests.

Studies of the nature of immunity and how produced.—The one point connected with contagious diseases which is mysterious beyond all others, and the elucidation of which promises the most important practical results, is the nature of the immunity conferred by vaccination, and the essential manner in which this insusceptibility is produced. There are those who believe they have produced immunity by hypodermic injection of liquids deprived of living germs, and all our present knowledge seems to point to this as possible. My experiments in this line have always failed, however, and yet they have been more numerous and probably more carefully conducted than those of any other investigator who has studied this question. It is a subject the importance of which cannot be overestimated, and I trust that the researches of the near future will remove the mystery which conceals it. If insusceptibility could be as easily produced by chemical products as by living germs, all the benefits of vaccination would be obtained with none of its objections. Surely there is no more important question that could engage our attention.

The distribution, preservation, and destruction of virus on fields and commons.—With Texas fever, particularly, we need much information in regard to how the germs leave the body, and why they are, as a rule, distributed by apparently healthy cattle and not by sick ones. We ought to know how the germs of this and other diseases are preserved on fields and commons, often under conditions which at first sight would appear destructive to them. Thus, Texas fever virus seems to be destroyed by frost, and yet in some way it survives severe winters. This and hog and chicken cholera are caused by micrococci, organisms of a limited period of existence, which die in the course of a few months unless they are in some medium suitable for their reproduction. How are these viruses preserved for weeks and months in yards and fields and woods?

Again, the destruction of the infection is a matter of great importance. With none of our most common diseases does the bacterial parasites form spores, and hence they are peculiarly susceptible to all unfavorable conditions of life, and to the action of disinfectants. Can we not destroy the infection of these diseases, then, by burning over the pastures, by plowing them late in fall and exposing the soil to atmospheric influences during the winter, or even by keeping all animals from them for one or two summers? Such questions are of especial importance to those who attempt to keep thoroughbred cattle at the South.

Respectfully submitted.

D. E. SALMON, D. V. M.

ASHEVILLE, N. C., *February* 1, 1883.

DISEASES OF SHEEP IN TEXAS.

REPORT OF DR. H. J. DETMERS.

HON. GEO. B. LORING,
Commissioner of Agriculture:

SIR: In the following pages I have the honor of laying before you my report on the diseases of sheep in Texas, or more particularly in the sheep-raising portions of Western Texas. Before I enter into the details of my investigations, allow me to say a few words in general. Western Texas, or those portions of the State in which wool-growing has developed into an important industry, is well adapted to sheep-raising; all conditions necessary are existing, and malignant diseases of sheep are perhaps less frequent than in any other part of the United States, provided the sheep are properly kept and taken care of, and no attempts are made to raise and to keep them on lands not adapted to sheep-raising. Sheep, but wool-sheep in particular, in order to be healthy, require a dry and salubrious climate, and a soil not inclined to be muddy or wet. Land full of sloughs, pools of stagnant water, "hog wallows" or "buffalo-wallows," or land that is low and level, constantly wet or soggy, or full of so-called "swales," &c., should never be used for sheep-raising. But as it is, many former lawyers, preachers, merchants, mechanics, &c., who know nothing about the requirements of a sheep, come to Western Texas—some of them for their health—and engage in sheep-raising, because the land is cheap and the business profitable. It is mostly these men who complain about losses caused either by a bad selection of locality or by bad management and want of proper care, while experienced flock-masters, who understand their business, and superintend their flocks in person, have very little cause to complain, and hardly ever do complain, about losses from disease. The only real drawback to sheep-raising in Texas—I mean Western Texas, as Eastern Texas is not adapted to wool-growing—is caused by the blow-fly, and perhaps, also, though in a much less degree, by the gad-fly, *Œstrus ovis*. The former, particulary in the summer, lays its eggs in any little wound or sore that is exposed, produced either accidentally or by marking, docking, castrating, &c., while the larvæ of the latter, as is well known, often cause serious trouble in the frontal and maxillary sinuses and in the nasal cavities and ethmoid bones. Still, an attentive flock-master suffers but very little from the causes just named. He has learned to destroy the larvæ of the blow-fly, the so-called "screw-worms." He carefully watches his sheep, and wherever the "screw-worm" makes its appearance he is at hand with his carbolic salve, his chrysalic ointment, &c., and destroys it. Besides, he avoids as much as possible to wound his sheep during the fly season, and performs all necessary operations, such as marking, docking, and castrating, either in the spring or in the fall. He also sees to it that no lambs are born in the summer, because he knows the blow-fly will immediately attack the naval of the new-born animal. As to the larvæ of the gad-fly, his task is a little more, but not so very difficult either. In the first place, he takes care that the nostrils of his sheep during the summer months are well anointed with tar or other substances which are objectionable to the gad fly, prevent it from depositing its eggs, or make it impossible for the latter to reach their destination. Further, knowing that the larvæ of the gad-fly are discharged from the nostrils of the sheep late

in the fall and in the winter, that once discharged they soon burrow into the ground, where they undergo their change into pupæ, and that the pupæ develop into flies in the spring and fore part of summer, according to their age; also that the gad-fly arrives at sexual maturity and commences to deposit its eggs in June, July, or August, as the case may be, and that hardly any more eggs will be deposited after September, an experienced flock-master will see to it that his winter range is not occupied by his sheep from June to September, and *vice versa.*

Among the diseases most damaging to the wool-growing industry, scab, of course, deserves the first place, but the Texas flock-masters have learned to manage that too. While formerly scabby flocks were the rule, at present they are an exception. Nay, more, in the whole southwestern part of Texas but very few flocks can be found affected with that disease, because every flock-master is on his guard. If he has the least suspicion he at once resorts to dipping, and once his flock is clean he knows that it will remain clean as long as no scab is imported. He therefore endeavors to protect his range against scabby droves of sheep coming from other places or other States, and the Wool-Growers' Association of Texas is making efforts to induce the legislature now in session to pass a very strict and effective scab law, such a one as will make any importation of scabby sheep next to impossible. Sheep driven into Texas through New Mexico from California are nearly all affected with scab, hence such a law will be very beneficial. The wool-growers of Texas desire a law which compels all imported sheep, but particularly such as come in droves, to be "dipped" twice before they are allowed to enter the State. If such a law is passed and properly executed, if the dipping is done in a thorough manner, if all other necessary precautions well known to every flock-master are observed, and the second "dipping" follows the first not earlier than the sixth nor later than the tenth day, there is a prospect that scab will soon be a very rare disease in Texas.

The most destructive disease of sheep undoubtedly is anthrax. It occurs, however, only in certain localities, and generally in those which are not adapted to sheep-raising, or in which the owners of the sheep are guilty of gross negligence. About anthrax of sheep I shall have a little more to say further on.

The only other diseases of sheep that deserve special attention as far as Texas is concerned are those which are caused by entozoa or worms. The fluke, *Distomum hepaticum*, which has its seat in the bile-ducts and in the gall-bladder, and is a curse to sheep-raising in many parts of Europe, occurs frequently only on the low and level lands near the Gulf, consequently on lands much better qualified for cattle than for sheep. In comparatively rare instances the fluke-worm, it is true, also occurs in other parts of Texas—for instance, as I was recently informed by Mr. C. Real, in Kerr County—but there, it seems, it owes its presence to recent importations, and will probably not gain a permanent foothold. Although the steadily growing trade in sheep, and particularly the constantly increasing importation of finer sheep from other States, will undoubtedly be followed by a more frequent occurrence of the fluke-worm, it may be safely predicted that in Texas, or rather in those parts of Texas better adapted to sheep-raising than to anything else, the fluke will not at any time cause any serious losses, because all those parts of the State which are more suitable for sheep than for cattle are on the whole too dry to afford favorable conditions for the preservation and propagation of that entozoon. In certain localities in Texas, viz., in the vicinity of Austin and of Fort Worth, and probably in some other districts,

occurs quite often a tape-worm, *Tænia expansa*, particularly in lambs; but it seems that the losses caused by this worm are not very serious. *Tænia expansa* occurs in the small intestines of sheep, but principally of lambs, and is sometimes found also in the small intestines of other ruminating animals, such as goats and cattle. It grows sometimes to an enormous length. Its head is very small and without hooks, and its joints or proglottides close to the head are also very small, while those further back gradually increase in size, so that the largest are very large and almost square. It is said that specimens occur which are one hundred feet long, and have proglottides, the largest ones, one inch in width. (Those I had an opportunity of seeing I estimated to be from twenty to thirty feet long, and their largest proglottides, or joints, appeared to be from half an inch to five-eighths of an inch in width.)

Of cyst-worms more than one species have been found at the various *post-mortem* examinations, and if I may judge from what I have seen, at least two species, namely, *Echinococcus veterinorum* and *Cysticercus pisiformis*, are of rather frequent occurrence, not only in sheep but also in rabbits. Whether or not they ever cause serious losses I am unable to state, because in nearly all cases in which I found them I also found other entozoa and other morbid changes evidently not caused by those cyst-worms. *Cysticercus cerebralis*, a cyst-worm which has its seat usually in the brain and occasionally in the spinal cord, and which occurs quite often in certain parts of Europe, has never been met with at any *post-mortem* examination, and I believe I am correct when I say its existence is almost unknown in Texas, and it is doubtful whether it ever has been found in that State.

As to the other cyst-worms mentioned (*Echinococcus veterinorum* and *Cysticercus pisiformis*) I shall have more to say below.

Far more damage than by all those entozoa just mentioned is done by two small, thread-like worms belonging to the genus *Strongylus*. The one, *Strongylus filaria*, a whitish, thread-like worm from 1 to 3½ inches long, is met with quite often, and sometimes in large numbers, in the bronchial tubes of sheep, but particularly in those of lambs, and cause, according to my observation, the most losses; is also, on account of having its seat in the lungs and not in the stomach or intestines, the most difficult to destroy. The other one, *Strongylus contortus*, a reddish-looking worm, is a trifle smaller, and occurs sometimes in immense numbers, but more frequently as a few specimens in the fourth stomach of lambs and of sheep, principally of the former. If present in large numbers it causes gastric disorders, more or less rapid emaciation, and anæmia, which not seldom terminate in death. The Texas flock-master calls the disease thus produced

LOMBRIZ.

Lombriz is a Spanish word, and means "worm." In Texas it is often indiscriminately applied to all cachectic or anæmic diseases of sheep, no matter whether caused by the presence of *Strongylus contortus* ("lombriz worm"), by other entozoa, such as *Strongylus filaria* in the lungs, cyst-worms in various tissues, and *Tænia expansa* in the small intestines, or by something entirely different. Still, the more experienced flock-masters make a distinction, and limit the term "*lombriz*" to the damage done by *Strongylus contortus* in the fourth stomach. In the following pages I shall use it in the same sense.

In your favor of March 7, 1882, you directed me to make an investigation of the diseases (of sheep) mentioned in an inclosed letter written to you by Mr. David M. Clarkson, of Brackett, Kinney County, Texas.

The diseases mentioned by Mr. Clarkson in said letter are scab, *lombriz*, and foot-rot. As scab is a disease which is well known to and rationally treated by every flock-master in Texas who has had any experience at all, and as foot-rot is practically an unknown disease in Texas—at least I have not been able to find or to hear of a case that originated within the borders of that State—I directed my principal attention to so-called *lombriz* and kindred diseases (worm epizootics). In your favor of the 7th of March you requested me to correspond with Mr. Clarkson. I at once complied with this request, but had to wait some time for an answer. When it arrived it was worded so as to cause me to conclude that *lombriz* was prevailing and causing great losses in Mr. Clarkson's flock of sheep. I received Mr. Clarkson's letter on March 31, and as soon as circumstances permitted, April 3, I went to his ranch, about 12 miles from Brackett, in Kinney County. I arrived there on April 4, and visited not only Mr. Clarkson's ranch, but also several others, among them the ranch of Mr. Newell, vice-president of the Texas Wool-Growers' Association (April 5, 6, 7, and 8). My trip, however, was productive of very small results, for no *lombriz* existed or could be found in any of the herds visited. Neither Mr. Clarkson nor his neighbors ever had a case in their flocks. Mr. Newell, it is true, had a few cases and suffered slight losses in 1881 in a newly-purchased flock of sheep that had not been raised in that part of the country. Neither could anybody give me any reliable information as to the nature of the disease. Of Mr. Newell I learned that the term "*lombriz*" is applied to a disease of sheep caused by a large number of small worms found in the fourth stomach, and that very likely no fatal cases would occur anywhere before June or July. As nobody could give me any definite description of the worms in question, notwithstanding I applied for information to quite a number of gentlemen supposed to be familiar with the subject, I had to wait for further developments. Finally, in May, through the kindness of Mr. John Wicheland, who has a sheep-ranch 14 miles from San Antonio, on the Martinez, I received specimens of the so-called *lombriz worm*, which had been taken from a sheep in August, 1881, and preserved in alcohol. From these tolerably well-preserved worms I soon recognized *Strongylus contortus*, and consequently knew what I had to deal with. Having taken pains to inform the sheepmen of Texas, through their papers, of my mission, letters and telegrams inviting me to come to the ranches and to investigate "*lombriz*" in a short time commenced to arrive. By complying as much as possible with these invitations I soon learned that the term "*lombriz*" is by many sheepmen, even by many who have been a long time engaged in sheep-raising, indiscriminately applied to every chronic disease of sheep which the shepherd—usually a very ignorant Mexican, who if a sheep dies hardly ever makes a *post-mortem* examination—is unable to diagnose. So it often happens that in many a flock of sheep the term "*lombriz*" covers all diseases that occur, and particularly all that prove fatal.

To relate all my disappointments in detail would be very tedious and of no practical use. I will, therefore, only mention a few instances. On May 17 I received a letter from the Texas Wool office, of which the following is a literal copy:

DR. DETMERS:

DEAR SIR: I to-day received a telegram from Mr. Nuessel, of Uvalde, saying that he has lombriz among his sheep, several lambs dying every day. I would like to have you visit him.

Yours, respectfully,

L. A. HEIL, *Texas Wool.*

I at once went to Uvalde, and found when I arrived at Mr. Nuessel's ranch, 5 or 6 miles north of Uvalde, that out of a large flock of sheep—6,000 or 7,000—only a few lambs—11 or 13, I believe—had died, and that no *post-mortem* examination had been made. It was difficult to find a sick lamb. Finally, an emaciated and rather poor-looking lamb was pointed out to me by Mr. Nuessel and his shepherd as being affected with *lombriz*. After it had been killed for a *post-mortem* examination nothing of any importance could be found except a quite extensive degeneration of the mesenteric glands, a general anæmic condition, and some serum in the throracic and abdominal cavities; or, in other words, what might be called a scrofulous condition and its natural consequences. Most of Uvalde County, and particularly Mr. Nuessel's ranch, is very dry, and therefore, as will be shown below, not offering favorable conditions for the preservation of worm brood, consequently is not apt to harbor much *lombriz*.

The first case of real *lombriz* I had an opportunity of seeing was at Mr. David Brown's ranch, in Atacosa County, about 16 miles south of Pleasanton. It was from May 24 to May 28. Mr. Brown, one of the oldest and most experienced flock-masters in Texas, and well acquainted with the disease in question, informed me that not much *lombriz* might be expected until the middle or latter part of June, except in its incipient stage, but, with his well-known generosity, pointed out a two-year old imported buck as being affected with that disease, and offered to kill the animal for a *post-mortem* examination. His offer, of course, was accepted. The buck was killed by bleeding, and quite a large number of small—not fully developed—*Strongyli contorti*, imbedded with their heads in the mucous membrane, were found in the fourth stomach. A subsequent microscopic examination proved the same, or at any rate a large majority of them, to be young worms, or worms not yet arrived at sexual maturity; still, the males and females, in a proportion of about one male to five females, could be plainly distinguished. In the same animal, however, I discovered another disease, in my opinion more serious, as will be explained below, than the presence of the entozoa in question in the fourth stomach. On opening the chest, taking out the lungs, and then opening the bronchial tubes, I found in the latter, but particularly those in the posterior portions of the lungs, numerous specimens of another *Strongylus*, which is known as *Strongylus filaria*. It is a little larger than the "*lombriz*" worm, and also of a different color, therefore easily distinguished. As to these two worms of the genus *Strongylus* the differences are as follows: *Strongylus filaria* (Rud.), which occurs in the bronchial tubes of lambs and sheep, sometimes in very large numbers, is a small, round, thread-like worm, tapering at both ends, but more gradually anteriorly than posteriorly. Its head is small, with mouth situated at the end, and its color is from a milk-white to a slightly dirty-looking white. The male worm measures in length from 1 to $1\frac{1}{2}$ inches, while the female is twice as long and not seldom measures fully $3\frac{1}{2}$ inches. Its thickness is about one thirty-sixth of an inch, or a little over two-thirds of a millimeter. The external sexual organs are situated at the posterior third of the body. *Strongylus contortus* (Rud.) is also a small, thin, thread-like worm, tapering toward both ends, but most toward the head, which is very small, and still smaller or more pointed than that of *Strongylus filaria*.* The color of both the

*There is an apparent discrepancy between my statements as to the size of *Strongylus contortus* and the size of my drawings. The difference, however, is only apparent, and can be readily explained. My statement gives the size of some large speci-

male and female worm while alive is more or less reddish or brownish, and the female is distinguished by its contorted appearance. The male worm, which is very thin, measures hardly an inch in length, while a full-grown female is about 2 inches long and one forty-eighth of an inch, or a trifle over half a millimeter, thick. The external genital organs of the female worm are situated nearly half an inch anterior to the posterior end of the body, or in the posterior third part of the same, and protected by a valve-like appendice, and the genital organs of the male worm are situated at the hind end of the body and there inclosed by two broad claw-like appendices, which during the act of copulation serve to embrace the body of the female. As a good many worms after they have arrived at sexual maturity can be found in the act of copulation, it must be concluded that the act occupies a considerable length of time. The ovaries of the female are very long, and appear in the fully-developed worm-like corkscrew-shaped bands winding around the intestinal canal, and give the female worm its peculiar contorted appearance. Mr. John Wickeland, who examined some female worms with a low-power microscope, compared their appearance with that of a barber-post. It may just as well be stated right here that the female worms of both species, of *Strongylus contortus* as well as of *Strongylus filaria*, produce innumerable eggs, which develop living embryos while yet in the ovaries, and that the mother worm, as soon as these embryos have reached a certain stage of development, prepares to leave its place and is discharged, *Strongylus filaria* by coughing and sneezing, and *Strongylus contortus* with the excrements of the sheep. Once discharged, the old worm soon dies and decomposes—*Strongylus contortus*, it seems, dies soon after it leaves the fourth stomach and before it is discharged—and then the embryonic worms, still inclosed in and protected by the shell of the oblong egg, become free, and will live, if a certain degree of warmth and sufficient moisture are not wanting where they happen to be deposited, till a heavy rain carries them into a pond, a water-hole, or a low, wet, and muddy place, in which they can pass their embryonic existence, either in muddy or stagnant water or on aquatic plants. If such water is used for drinking by lambs or sheep, or if the latter eat the aquatic plants, the embryonic worms reach their place of destination. Of course a great many embryonic worms, there can be no doubt, will perish, but as the eggs produced by each female worm are exceedingly numerous, and as the female worms outnumber the male worms about five times, there is no danger that the worm brood will become extinct, even if of every thousand embryos produced only one or a few reach a place—if *Strongylus contortus*, the fourth stomach, and if *Strongylus filaria*, the bronchial tubes of a lamb or a sheep—where they can develop to maturity. Hence, as long as flock-masters and shepherds allow their sheep and lambs to drink the stagnant water of pools, water-holes, hog-wallows, &c., and to eat the aquatic plants growing in or near such pools and water-holes, particularly if the range is infested with the brood of these worms, their propagation and future existence are abundantly secured. They will become extinct, though, if sheep, particularly from March to July, are not allowed to graze on land on

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mens (the largest that could be found) of fully-matured worms while fresh and yet alive, while my drawings, made some months afterward, represent worms preserved in alcohol since September, and consequently somewhat shrunken. For instance, the drawings from the camera lucida of the female represents a large worm magnified precisely 42 diameters, and if the width is measured it will be found to be about 0.4 millimeters, or nearly $\frac{1}{62}$ of an inch, instead of $\frac{1}{48}$ of an inch, as stated in my report. In length the shrinkage is just as great, if not greater.

which worm brood has been deposited, and are prevented from drinking stagnant water and from eating aquatic plants. The embryos of *Strongylus contortus*, once swallowed, soon reach the fourth stomach, where they burrow with their heads into the mucous membrane, while the embryos of *Strongylus filaria*, according to some authors (Colin), ascend from the stomach through the œsophagus, and then descend through the larynx and windpipe into the bronchial tubes. Whether such is the case, or whether the embryonic worms reach their destination in a more direct way, that is, directly from the throat through the larynx and windpipe, without first passing into the stomach, I am unable to decide.

At the *post-mortem* examination of Mr. Brown's two-year-old buck the other morbid changes present consisted in watery exudations in the thorax, in the adbominal cavity, and in the subcutaneous tissues between the lower jaws and at the throat, and of course must be considered as the consequence of the anæmic condition and general decline caused by the presence of the worms.

After this experience with so-called *lombriz* I visited several sheep ranches in different parts of the State, but in every instance was disappointed and found not what was promised and expected; on the contrary, it was always some sporadic disease as will occasionally occur in every flock of sheep.

On the ranch of Mr. William Gerfers, near the Cibolo, and about 22 miles from San Antonio, I had another opportunity, on June 9, 10, and 11, to observe real *lombriz*, as well in living animals as at *post-mortem* examinations. In the living animal the symptoms are about the same as those caused by other intestinal entozoa, and consist in irregular digestion, more or less constipation followed by diarrhea, increasing weakness, emaciation, paleness of the skin and of the visible mucous membranes, anæmia and watery exudations, particularly in the subcutaneous tissues between the lower jaws and at the throat. At first the temperature is increased above normal, but immediately before a fatal termination the same often sinks to several degrees below normal. To give the exact symptoms of pure *lombriz* is rather difficult, because the lambs and sheep infested with *Strongylus contortus* in nearly every case also harbor other entozoa, such as *Strongylus filaria* in the lungs, various cyst-worms in other tissues, and besides are usually troubled with the larvæ of the gad-fly in the nasal cavities, ethmoid bones, and frontal and maxillary sinuses, which of course all contribute to complicate the symptoms.

One lamb and two muttons (wethers) were killed by bleeding in my presence. In the lamb I found tuberculosis in the lungs, extending to about one-third or more of the whole pulmonary tissue, and in the fourth stomach several but not very many worms of the *Strongylus contortus* kind. The ethmoid bones contained several larvæ of the gad-fly, *Œstrus ovis*. No other morbid changes of any importance.

In the first wether I found "screw-worms" (larvæ of the blow-fly) in one foot, quite a number of *Strongylus filaria* in the bronchial tubes, a few *Strongylus contortus* in the fourth stomach, and numerous sterile or aborted cyst-worms on the serosa of the large intestines. Several of the mesenteric glands showed fatty degeneration.

In the second wether I found a few tubercles in the lungs, but no *Strongylus filaria* in the bronchial tubes, a few *Strongylus contortus* in the fourth stomach, and some aborted cyst-worms in the serosa of the large intestines. This second wether, or mutton, which presented when alive the appearance of a perfectly healthy animal, and proved to be

very fat, was butchered for meat, while the lamb and the first mutton, or wether, appeared to be sick when alive, and were killed for *post-mortem* examination. Both animals were in poor flesh, the lamb probably on account of its tuberculosis, and the wether undoubtedly had been damaged much more by screw-worms (the larvæ of the blow-fly) than by anything else. The temperature of the lamb before it was killed proved to be 103°.8 F.

Mr. Gerfers, who is considered by Texas sheepmen as one of the most experienced flock-masters in Texas, believes that on a once infected sheep-range every sheep harbors at the proper season—from June to September—at least a few *lombriz* worms (*Strongylus contortus*) in the fourth stomach, but shows symptoms of disease—is damaged—only if those worms are very numerous, or if the constitution of the animal, from other causes, is a weak one. My own experience does not contradict his views; on the contrary, if it were expressed somewhat less sweepingly, if the word "nearly" were inserted before "every sheep," I would have to indorse it.

On June 13 and 14 I visited Mr. A. Real's sheep-ranch, 11 miles from San Antonio. I found no diseased sheep, and range in a very good sanitary condition. Knowing that the so-called jack-rabbits, which are very numerous in Western Texas, often harbor large numbers of cyst-worms, similar in appearance or identical to those I so often found in sheep reported to be affected with *lombriz*, and that the corresponding tape-worms, *Tænia serrata* and *Tænia echinococcus*, occur in dogs, wolves, and coyotes, I made it a point to procure or to shoot one or more jack-rabbits on every sheep-range, because it appeared to me probable that the large number of rabbits essentially contributes to the propagation of the cyst-worms, and indirectly causes their frequent occurrence in sheep. The coyotes, wolves, and dogs catch the rabbits and eat them; the cyst-worms of the rabbits in that way pass into the stomach and intestines of the coyotes, wolves, and dogs, and develop into tape-worms, and these animals, thus getting tape-worms, deposit their excrement, and with it the ripe or pregnant tape-worm-joints, or proglottides, full of eggs, on the grass. As the proglottides once discharged will soon decompose, the eggs become free, and, possessing great vitality, they are not easily destroyed by external influences; have a very good chance of being picked up by sheep and rabbits that come along and eat the grass. At Mr. Real's range I killed one rabbit, and found it healthy, or free from cyst-worms. To avoid unnecessary repetitions, I may here state that wherever I found cyst-worms in sheep, I also found them in the rabbits, and *vice versa;* wherever the sheep were free, there the rabbits, too, had no cyst-worms. I therefore advocated an extermination of rabbits and coyotes, at least on all the ranges on which the sheep are infested with cyst-worms.

On June 14 and 15 I visited Mr. John Wickeland's ranch, on the Martinez, 14 miles from San Antonio. A fat mutton, apparently in perfect health, was killed for meat in my presence. The carcass was very fat. In the lungs, however, I found a few miliary tubercles, and in the fourth stomach a few *Strongylus contortus.* I just mention this case to show that a small number of *lombriz* worms do not seem to interfere with the well-being of a sheep. Before I returned to San Antonio I shot four rabbits, but found them free from cyst-worms.

On June 16 I received a telegram, and on June 17 a letter, both dated Uvalde, from a Mr. McLawrence, stating that his sheep were dying every day by the dozen. I at once answered by telegram and by letter that I would be at Uvalde on June 19, and asked Mr. McLawrence to have a

conveyance for me at the depot to take me to his ranch. Accordingly I left San Antonio on the morning of the 19th and arrived at Uvalde in the afternoon of the same day, but found on my arrival that Mr. McLawrence, immediatly after he had telegraphed to me, had left for his ranch, which I learned was 50 miles from Uvalde in the Frio Cañon, and can be reached only over a trail leading through an almost uninhabited country. Fortunately I became acquainted with Mr. J. V. Abrams, another flock-master, who lives on the Nueces, 8 miles from Uvalde. Mr. Abrams took much interest in my mission, and offered to procure a team and to go with me to Mr. McLawrence's ranch. His kind offer, of course, was accepted. As I did not wish to lose much time, we left Uvalde on the evening of the 19th, and arrived the next morning at about 8 o'clock at Mr. McLawrence's residence in the Frio Cañon. Whether the location is in the northern part of Uvalde County or in the southern part of Bandera County I did not learn. On my arrival I soon ascertained that the sheep that died—in all about 150 to 160 head out of a flock of 1,100—had not died of *lombriz*, but of *anthrax*, and that they had continued to die at the rate of 12 to 15 a day as long as they occupied a certain range which contained two pools of stagnant water, but had stopped dying as soon as they were removed to another place. As the sheep had been removed on Saturday—I arrived Tuesday morning—at a range 7 miles below (south) in the same cañon, I did not find any diseased sheep, neither did I find any that had recently died; consequently I had no subject for a *post-mortem* examination. When later in the afternoon the flock was inspected, no animal could be found that showed any symptoms of disease. Once there and convinced by what I learned on making inquiries from Mr. McLawrence and his shepherd that the sheep had died of anthrax, I endeavored to ascertain the cause. I therefore concluded to inspect and to examine the fatal pasture-ground, and as it was only 2 miles above (north), I induced Mr. McLawrence to take me out there. Commencing about 1½ miles from the house, we found the ground strewed with the decomposed and decomposing carcasses of dead sheep, half eaten by the buzzards, and lying in heaps of twos, threes, and fours. Near a water-hole, the largest of the two stagnant pools, about 50 yards long, 10 yards wide at its widest point, and rather shallow, the carcasses became very numerous. I counted about 60 dead sheep in the immediate vicinity of the stagnant pool, and found one in the water itself. Being always provided with some small vials when on such an expedition, I filled two of them with some of the stagnant water and took them with me for microscopical examination. It was very foul and muddy, and its nauseating smell nearly turned my stomach when I filled the vials. When the water was examined under the microscope, on June 23, it was found to contain immense numbers of *spirilla*, *micrococci*, and *bacilli*, the latter undoubtedly *Bacillus anthracis*. It also contained large quantities of granular matter, a good many vegetable rests, some animalcules, and numerous spores of algæ, &c. Consequently no doubt can exist that the water-hole, which, for about two weeks, or from the time the sheep commenced to die till the flock was removed to another range, furnished the drinking-water for some of the sheep, probably, though, only for those that died, as other good water, in the Rio Frio, was equally accessible, and only a mile distant, constituted the source of disease and death. The other stagnant pool, reported to be much smaller and nearly dry, was not visited.

On further inquiry I learned that in the fall of 1881 the same range—the vicinity of the water hole—had been occupied a few weeks by a herd

of cattle, and that about 60 of them had died within a short time. The dying, I was informed, ceased immediately after the cattle were taken away to another place. Further, that in the spring of the same year (1881) a flock of sheep had been grazed a short time on the same range, and that 120 head of them had died in a few weeks, and that they likewise had stopped dying when removed to another locality. Of course none of the dead animals were buried; they all, as is customary in Texas, were left on the ground to rot, and to be devoured by the buzzards and coyotes. The whole range, therefore, is thoroughly infected, and as the land slopes in nearly every direction toward the water-hole which furnished the drinking-water, or at least a part of it, for most of the animals grazing in its vicinity, there can be no doubt that the cause of the fatal disease (*anthrax*), was local, and was caused by drinking the stagnant water contained in the water-hole. That the water was thoroughly infected was proved by the presence of numerous *Bacilli anthracis*. Further comment will hardly be necessary.

Arrived again in Uvalde on the night of June 20–21. Knowing that cyst-worms are of frequent occurrence in sheep in the neighborhood of Uvalde, I procured in the morning, through the kindness of Mr. Abrams, four jack-rabbits, and found every one of them infected with numerous cyst-worms, containing fully-developed scolices. The cyst-worms were situated nearly everywhere in the abdominal and pelvic cavities, particularly near the kidneys and urinary organs, but also in and between the muscles. One of the rabbits contained about thirty, and another one over twenty.

In the early part of July (July 3 and 4), on my trip to Corpus Christi, I stopped in San Diego, Duval County, and from there visited several sheep-ranches on which the sheep were reported to be affected with *lombriz*. I had an opportunity of making a few *post-mortem* examinations on the ranch of Knight Brothers, 14 miles from San Diego (July 4), but found nothing of special interest except some *Strongylus contortus* in the fourth stomach, and in one lamb a few *Strongylus filaria* in the bronchial tubes. In 1880 Knight Brothers had a flock of 3,500 sheep, and suffered no losses from *lombriz*; the sheep, the whole year, were in a very good condition, and did not emaciate during the winter. In 1881 they had about 4,300 sheep; the winter was a hard one, and the animals, in consequence, were rather poor in the spring. The losses from *lombriz* in the summer of 1881 amounted to about 400 lambs. In 1882 their flock of sheep numbered 5,000 head, which, owing to a mild winter, were all in a good condition in the spring, at any rate in a much better condition than in the spring of 1881. The losses till date, July 4, have been very few. The range, I was informed, has been in use five years, and no losses from *lombriz* (fatal cases of worm disease) worth mentioning have occurred, except in the summer of 1881. Still, I saw a few lambs evidently affected, but none of them were as yet very sick. The range, on the whole, is very dry, and almost destitute of water except in a wet season. The sheep, and also a flock of goats, obtain water for drinking from a so-called tank, an artificial pond, which is 400 yards long, and contained on July 4 about 3 feet of water. Knight Bros. are of the opinion that the greater loss in 1881 was caused by the poor condition of their sheep in the spring of that year. As it is a well-known fact that parasites, and entozoa particularly, become as a rule dangerous to higher organized animals only when the latter are weakened, diseased, emaciated, or in a declining condition; that, in other words, parasites flourish the more the weaker the organism of their abode animal; therefore, the reason given for the greater loss caused

by *lombriz* in 1881 than in 1882 is a very plausible one. As long as most of the flock-masters in Texas do not make suitable provisions for their sheep in the winter, and do not feed and protect them in bad and cold weather, or when a "norther" is blowing, every severe winter, that is, severe for Texas, will not only cause immediate losses, but will also increase the death-rate of the sheep in the following spring and summer. As the present winter (1883) is a hard one, it is safe to predict that the death-rate next spring and next summer will be a high one, and not only as to sheep, but also as to other animals. Although Texas is a southern country and has a warm climate, the changes of weather and temperature are just as severe and just as sudden as they are further north.

In the fore part of August I received information that quite a number of sheep were dying near Gonzales, Gonzales County, particularly in a flock owned by Messrs. Stieren & Forke. I went there at once, and, together with Mr. Stieren, the senior member of the firm, visited (August 15) their sheep ranch, several miles from the city. The flock consisted of about 3,000 head, including about 1,000 lambs. Of the latter, about 250, or 25 per cent., had died within the last four or five weeks of a disease alleged to be *lombriz*. When we arrived at the ranch we found that the flock had recently been moved by the shepherd to another range, a few miles further north, and that the dying had almost entirely ceased since the removal had been made. Only a few deaths had occurred during the last two or three days. I left it to Mr. Stieren and his shepherd to pick out the sickest lamb in the flock to be killed for *post-mortem* examination. It was killed by bleeding. Examining it, I found grubs (larvæ of the gad-fly) in the sinuses and ethmoid bones, a few large specimens of *Strongylus filaria* in the lungs, some *lombriz* worms—*Strongylus contortus*—in the fourth stomach, and degenerated mesenteric glands. The range, but particularly the old one (the one occupied by the flock till within a few days of my arrival), contains numerous small water-holes, or rather creek-ponds, which become dry in the summer, or in every dry season contain more or less water after a good rain, and form a continuous stream (a creek) only after heavy rains, or in a very wet season. Besides, the old range, partly at least, is composed of so-called hog-wallow land, and in a wet season each hog-wallow forms a small water-hole. From the above it will be seen that the range in question is not at all adapted to sheep-raising, but admirably qualified to preserve worm-brood.

On August 29 I had an opportunity to examine a diseased flock of sheep belonging to Mr. Boaz, in Fort Worth, Tarrant County. Mr. Boaz bought in June a flock of 271 sheep, among them 25 muttons (wethers), the rest ewes and lambs. These sheep, on the whole, rather inharmonious cross-products of Cotswolds, Lincolnshires, Leicestershires, Mexicans, and Merinos, were imported from Missouri in the latter part of March, and since that time have been kept and herded in the vicinity of Fort Worth. In the latter part of June, or immediately after Mr. Boaz took possession, the sheep commenced to die at the rate of one a day on an average. In all 59 animals, mostly lambs, and including only a few full-grown, probably very old sheep, had died when I arrived. The symptoms observed in the animals found diseased were as follows: At first a tendency to remain behind in the herd; a slight drooping of head and ears, then gradually increasing weakness and emaciation; paleness of skin and visible mucous membranes; more or less coughing and sneezing and discharges from the nose (in most of the animals); irregular appetite and digestion, and at times costive-

ness and more or less fever, till finally the weakness, emaciation, anæmia, and fever increased, and the costiveness gave way to a more or less fetid diarrhea, which, in most cases, was soon followed by death. Mr. Joe Dickson, the overseer of Mr. Boaz's ranch—Mr. Boaz is a banker, and lives in Fort Worth—and myself singled out and caught two lambs, which, in a high degree, exhibited all the symptoms mentioned. The temperature of the animals, taken in the rectum, was 104°.8 and 103°.4 F., respectively. Hence, the first one, having the highest temperature, and being apparently the sickest, was killed by bleeding for the purpose of making a *post-mortem* examination. The morbid changes presented were as follows: *Œstrus* larvæ, a few, in the ethmoid bones; some lung-worms, *Strongylus filaria*, in the bronchial tubes, but unmistakable indications that many more had been present, which had probably been ejected by coughing and sneezing, and an immense number of *lombriz* worms, *Strongylus contortus*, in the fourth stomach. Besides that, the mesenteric glands presented considerable fatty degeneration. No other morbid changes could be found. The worms in the fourth stomach were so numerous as to give the whole mucous lining of that organ an appearance somewhat similar to that of a coarse felt saddle-blanket, in which every hair is curly, in motion, and wriggling. Consequently there can be no doubt that I had before me a case of veritable *lombriz*, one that would have terminated in death if the animal had not been killed by bleeding. As Mr. Boaz kept on the same range another flock of sheep, animals of his own raising, and crosses between the common Mexican sheep and American Merinos, which were all, without exception, in a good and healthy condition, it became evident that the imported sheep did not become affected while on his range or in his possession, and that they must have picked up the worm-brood at some other place. Still, even his range, or at least a portion of it, contains numerous hog-wallows, and low, wet places, and therefore all the elements necessary to preserve the worm-brood, if once deposited. Such is the case on a great many Texas sheep-ranges. Of course, as long as no worm-brood is present or introduced, hog-wallows, low, wet places, water-holes, small ponds, &c., cannot produce it, but if worm-brood is once introduced, those places afford all the conditions necessary to the embryonic life of the worms belonging to the genus *Strongylus*, and of a good many others. The worms are usually introduced with imported sheep, which deposit the worm-brood on the grass, or directly in the water, and if then the conditions necessary to the embryonic existence of the entozoa are given, a range once infected very likely will remain infected till abandoned, for at least a year or two, as a sheep-range. I therefore advised Mr. Boaz to keep his sheep away from the hog-wallow portion of his range, and to use the same, at least a year or two, exclusively for cattle, so as to give the worm-brood a chance to die out.

On August 30 I went again to Mr. Boaz's sheep-camp, and killed another lamb for *post-mortem* examination. Its temperature before death was 104°.4 F. The carcass was found to be very anæmic; head and lungs were perfectly healthy, but innumerable "*lombriz*" worms, *Strongylus contortus*, were found in the fourth stomach. No other morbid changes were present, except some degeneration of the mesenteric glands, and a few rests of aborted cyst-worms in the mesenterium. The result of this second *post-mortem* examination convinced me still more that in Mr. Boaz's herd I had to deal with severe and fatal cases of *lombriz*. Hence, finding in the imported flock quite a large number of animals, both lambs and sheep, in a condition very similar or even identical to that of

the two lambs killed for *post-mortem* examination, I considered the herd a very suitable one to experiment with as to medical treatment, &c. As the worms are in the stomach, and therefore exposed to the effect of the medicines given, the only difficulty consisted in selecting from among the large number of anthelmintics known to materia medica one that is effective, requires as little preparation as possible, is easily administered to a large number of animals, and is not too expensive. The Texas flock-master has, as a rule, very large flocks, and concerning a medical treatment will only consent to give such remedies as are easy and simple of application, and can be given in a kind of wholesale manner. I therefore chose a solution of tartar emetic in rain-water, in a proportion of ten grains to two ounces, or half a pound of tartar emetic to twelve quarts of rain-water, and desired to give to each lamb, according to its size and age, from one to two ounces of that solution as a drench, and to older sheep a little more, in proportion to their size and weight. The result was an excellent one; all those animals not already too weak or too anæmic to be past recovery, even if free from worms, recovered. The tartar emetic not only freed the animals of *Strongylus contortus*, the "*lombriz*" worm, but also a large tape-worm, *Tænia expansa*, from a lamb that was supposed to be suffering only from *lombriz*. Besides that, sheep will stand without damage a comparatively large dose of tartar emetic, much larger in proportion than any other domesticated animal. As it is essential in administering anthelmintics to animals that the stomach of the latter at the time the medicine is given be not too full of food, the best way to give the solution of tartar emetic to a large flock of sheep is probably as follows: First drive the whole flock, or as many sheep as can be drenched in one day or an evening, into the shearing-pen, which is on most sheep-ranches the best suited place for the purpose, and leave the sheep there over night without any food. Then in the morning employ three men and a boy to do the necessary work. One of the men has to catch the sheep and to lift them one by one as they are wanted over a fence, when another man takes hold of them and holds each sheep while it is drenched. A third man, who may be the owner or overseer of the flock, attends to the drenching, and gives each sheep or lamb its proper dose out of a small bottle—a two-ounce vial I would prefer—and in small swallows, for then the medicine will almost immediately reach the place where it is wanted, the fourth stomach; whereas, when given in big swallows, or poured down in a hurried manner, it is apt to pass into the paunch and will then, mixed with the contents of the latter, lose much of its efficacy. The boy, or the fourth person, must have his place near the man who does the drenching, and attend to the filling of vials in use. The solution itself may be kept in a bucket handy to the boy. If proceeded with in that way 500 head of sheep can easily be drenched in one day. In order to prevent the sheep from filling their stomachs with food immediately after they have taken the medicine, it may be well to keep them an hour or two in the inclosure after the last one has been drenched. There are, of course, other effective remedies besides tartar emetic. Some flock-masters claim to have seen good results from large doses of common salt, while others have used oil of turpentine with good success. As to oil of turpentine, nothing can be said against it, except that with safety it can only be given in the form of an emulsion, and to make an emulsion for a large flock of sheep is much more trouble than the average Texas sheep-man is willing to take. The late Professor Gerlach, in Berlin, recommended creosote in the water for drinking, and considered two ounces and a half a sufficient dose for 100 sheep. As I was not able to obtain a reliable article when

I had use for it, I did not test its efficacy, but hope that others will. There will be abundant opportunities next summer.

CONCLUSIONS.

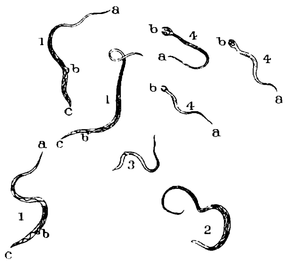
As will have been seen from the above, so-called *lombriz* becomes a destructive disease or causes severe losses only if the affected flock of sheep is in a bad—weak, emaciated, and anæmic—condition, or where the range is badly infected with worm-brood and not adapted to sheep-raising on account of the favorable conditions it offers for the preservation of entozoa (worms) while in their embryonic state. I would exclude from a sheep-range, but particularly from a lamb-range, first, all such land as is low and level and inclined to be wet; secondly, all so-called hog-wallow or buffalo-wallow land; thirdly, all such land as contains small pools of stagnant water, not to speak of swamps, sloughs, and swales. It is true, sheep need but little water compared with what is needed by other animals, but they need some, and what they need is water of the very best quality, or water that is as free as possible from decaying organic substances, and consequently free from (pathogenic) schizophytes and worm-brood. Really good, pure water, good well-water in particular, is not apt to contain dangerous schizophytes, neither is it well qualified to preserve and to sustain the life of embryonic worms, consequently is not productive of disease. As most of the sheep-ranges in Texas are rather scantily supplied with good water, the flock-masters who own their range, as most of them do, and have not a sufficient supply of good water, will be obliged to dig wells—artesian wells where necessary—and doing that they will soon find that the money thus invested will bear big interest.

I made one visit to a sheep-ranch in Hays County at which the sheep were dying, and found the cause to consist exclusively in the bad and filthy condition of the stagnant water of the rapidly-drying pools out of which the sheep had been drinking. There is still one other thing that deserves the special attention of the Texas flock-masters. Every year a great many improved sheep are imported into Texas, principally from California, Vermont, Ohio, Michigan, and from several other States, and these imported sheep are the ones that introduce not only scab and foot-rot—which latter, by the way, is a very rare disease in Texas—but also every kind of worm-brood. The Texas flock-masters, therefore, in importing sheep or in buying imported sheep, cannot be too cautious in seeing to it that he gets perfectly healthy animals, belonging to healthy flocks, and none that are suffering from or infected with any of those diseases named. Most of the diseased sheep or sheep afflicted with entozoa that are imported are brought in by dealers, and by them are sold usually in lots, which contain good ones and poor ones, to the highest bidder or in open market, after they have been driven through the whole State or a large portion of the same, and thus been permitted to infect more than one range. Besides that, they usually come in the fall, the very season in which most of the worm-brood is disseminated. What remedies or preventives may be necessary to avoid an infection of a sheep-range with worm-brood may be concluded from the above. It is not for me to say what ought to be done. It is for the flock-masters themselves to act and to decide, or to adopt such measures as will meet the object in view.

Very respectfully submitted.

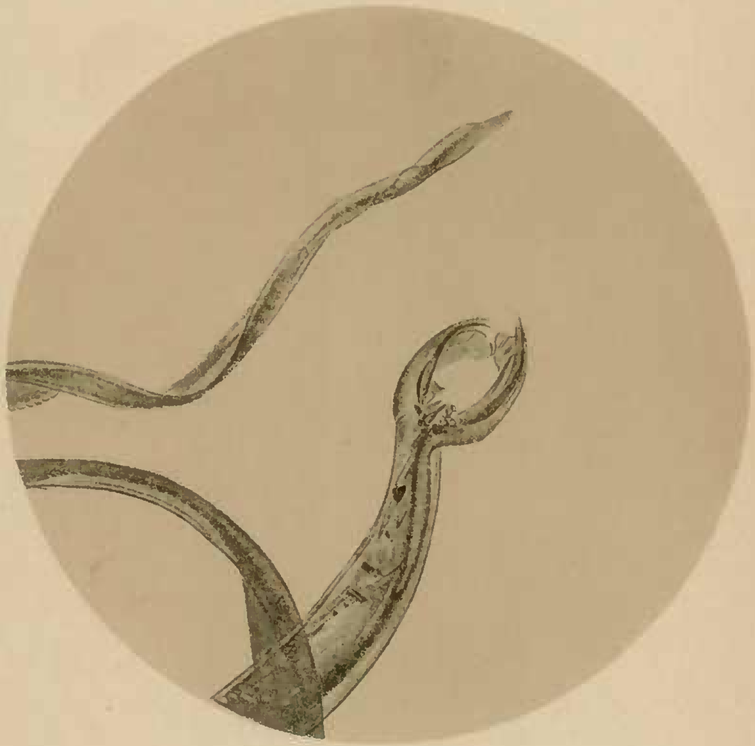
H. J. DETMERS.

CHAMPAIGN, ILL., *January* 29, 1883.

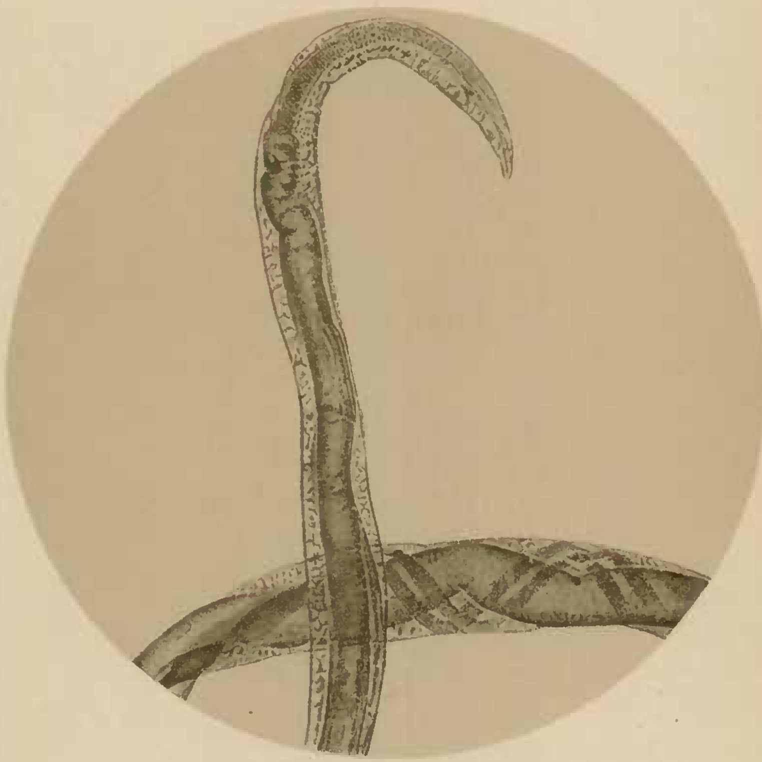


Group of Strongylus contortus, natural size.

1.1.1. full-grown females.
2, not fully developed female
3, young female
4.4.4, full-grown males
a.a.a.a, head,
b.b.b.b, genital organs of both sexes.
c.c.c. tail and anus of female.

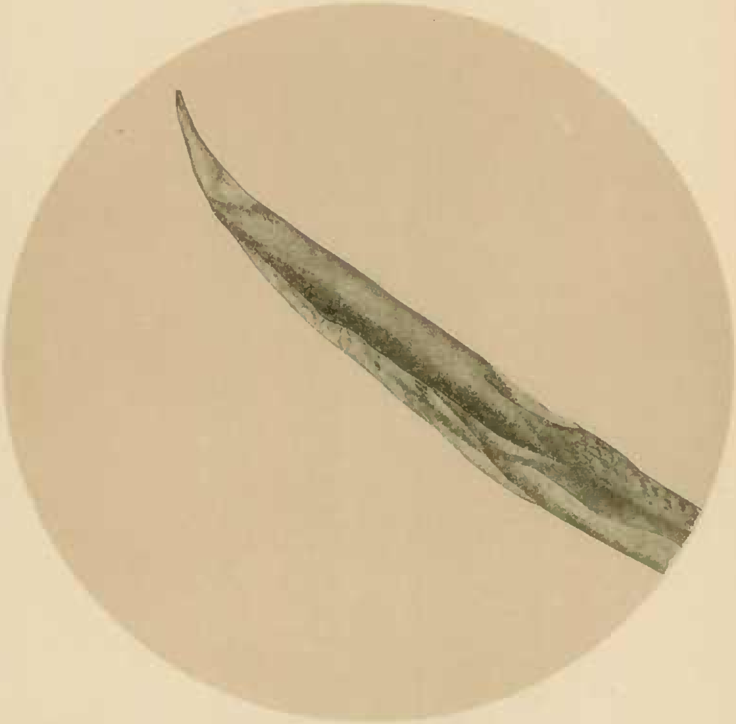


Microphotograph of head and tail of male Strongylus Contortus x 40.



Microphotograph of head of female Strongylus Contortus - x 40.

Microphotograph of middle portion of female Strongylus Contortus x 40.



Microphotograph of tail of female Strongylus Contortus x40.

REPORT OF THE BOTANIST.

SIR: I have the honor to submit the following report of the work of this division for the current year:

GRASSES OF THE GREAT PLAINS.

The Plains, lying west of the 100th meridian, together with much broken and mountainous interior country, nearly treeless and arid, in New Mexico, Western Texas, and Arizona, are nearly useless for the purposes of ordinary agriculture, but are becoming more and more important as the great feeding ground for the multitudes of cattle which supply the wants of the settled regions of our own country, as well as the constantly increasing foreign demand. The pasturage of this region consists essentially of native grasses, some of which have acquired a wide reputation for their rich, nutritious qualities, for their ability to withstand the dry seasons, and for the quality of self-drying or curing, so as to be available for pasturage in the winter. This quality is due probably to the nature of the grasses themselves and the effect of the arid climate. It is well known that in moist countries, at lower altitudes, the grasses have much succulence; they grow rapidly, and their tissues are soft; a severe frost checks or kills their growth, and chemical changes immediately occur which result in rapid decay; whereas, in the arid climate of the Plains the grasses have much less succulence, the foliage being more rigid and dry, and therefore when its growth is arrested by frost or other causes the tissues are not engorged with water; the desiccating influence of the climate is sufficient to prevent decay, and the grass is kept on the ground in good condition for winter forage.

Many of the grasses are popularly called "bunch-grass," from their habit of growth; others are known as "mesquite" and "gramma grass." These consist of many species of different genera, some of them more or less local and sparingly distributed, others having a wide range from Mexico to British America. In the consideration of this subject two very important questions arise: First, what effect will continued feeding have upon the perpetuity of the grasses composing these great pastures; and, second, what means can be employed to select native species or to import exotic ones such as may be adapted to the conditions of climate and soil here prevailing.

There can be no doubt that continued pasturage will ultimately produce important changes; certain species will disappear, being unable to withstand the constant tramping and cropping by cattle, and their place will be filled by more hardy species, either by self-propagation or by careful introduction and cultivation by the proprietors of the ground. It is probable that among the native species there are those which will meet the requirements of the occasion, but much careful observation and many trials and experiments will need to be made before the question is satisfactorily determined. To an intelligent performance of this work a knowledge is first required of the characteristics, habits, and names of the species now occupying the ground, and as a very impor-

tant aid to the acquisition of this knowledge we give in the present report descriptions and figures of many of the common grasses now prevailing in the region under consideration. A careful study of these and comparison with the living plants will enable an ordinary observer to identify the grasses which may come under his observation. An ordinary lens or magnifier will be a necessity in the examination of the minute parts of the flowers.

In some portions of Texas a careful study of the native grasses has resulted in the discovery of a number of species which promise to fill all the requirements of pasturage in that region. These species have been described and discussed in previous reports. In continuation, however, of the subject, and in view of its bearing on the present inquiry, we give herewith the substance of a recent letter from a correspondent in Lampasas County, Texas:

The Agricultural Report for 1881-'82 is at hand. I was especially interested in the report of the botanist. The Texas blue grass which is recommended I have found in my yard. I observed it closely last winter, not knowing what kind it was until it bloomed. At first I noticed about half a dozen bunches; now it has spread, by means of underground stolons, until I have quite a quantity of it. How it came to be in my yard I cannot tell, as I find it nowhere else in this vicinity. I also find it growing luxuriantly in the Colorado bottoms about 20 miles west, in Burnet County. It spreads very rapidly, almost equal to Bermuda grass or curly mesquite. I think it is just *the* grass. I have been looking for a winter grass. In the great grazing regions of Western and Southwestern Texas it is impracticable to try grasses that require to be set by cultivation, as but little of the land is tilled. We want grasses that will take care of themselves, and I think Bermuda for summer and Texas blue grass for winter will answer every purpose. Of native grasses we have two kinds that excel all others: 1st, the *Buchlœ dactyloides*, known as curly mesquite, wire mesquite, running mesquite, fine mesquite, and buffalo grass; this is a good summer grass, and is fair for winter, as it is only partially killed by frost; 2d, the other grass is the *Stipa setigera*, known as bunch mesquite, winter mesquite, big-bearded mesquite. This is pre-eminently *the* winter grass of a large portion of Texas, but of no value for summer. It is found with the live-oak. In my yard I have enumerated twenty kinds of native grasses, among them *Aristida purpurea*, *Bromus unioloides*, knot-grass, fall-grass, and others which I do not know the names of. The sedge grass is fast giving way to mesquite, especially on our sheep walks, which I consider a misfortune, as the sedge grass furnishes excellent range for nine or ten months of the year. It requires to be closely pastured in order to keep it from gowing too rank. For cultivated lands, Johnson grass, alfalfa, and Texas millet (*Panicum Texanum*) succeed well here. The millet is undoubtedly the finest forage grass in existence. For horses, cattle, or sheep it is excellent. They prefer it to any other kind of hay, or even to sheaf oats. It is raised in this section by plowing the land after a crop of small grain has been harvested. It is a sure crop, and produces two or three tons per acre.

The common names applied to grasses vary greatly in different localities, so much so that when the common name only is given we are frequently unable to determine accurately what grass is meant without the help of specimens. The name "bunch grass" is applied to a large number of species, as, for instance, to *Stipa setigera*, *Stipa spartea*, *Stipa viridula*, *Stipa comata*, *Eriocoma cuspidata*, *Festuca ovina*, *Festuca scabrella*, *Deschampsia cæspitosa*, and others which have the habit of growing in dense clumps. The names "mesquite" and "gramma" grass are applied to several species of *Bouteloua*, to *Buchlœ dactyloides*, to *Munroa squarrosa*, and others. But in botanical phraseology every species of grass has a name by which it is known everywhere. Hence the importance of acquiring the proper botanical names of the grasses.

In the range of country under consideration there are probably two or three hundred species of grasses, many of which have little or no agricultural value, but from them there can probably be selected such as have vigor of growth, nutritive qualities, hardiness, and sufficient foliage for a productive crop.

THE CHEAT QUESTION.

In some portions of the West there is great complaint of the prevalence of cheat, or chess, in the wheat-fields. In some cases there is little else than cheat where wheat was sown. This is an old trouble, and occurs more or less extensively after every severe winter. Many farmers, perhaps a majority of them, consider this a case of transmutation or degeneracy of the wheat. They think that the action of frost or some other cause has produced a change in the wheat-plant so that it is transformed into cheat. Accordingly they frequently say that their wheat has turned to cheat. They will admit that it is a strange occurrence, and without a parallel in their experience of the cultivation of other plants; but there is the cheat where they sowed wheat, and therefore the wheat has turned to cheat. They reason differently from the husbandman in the parable, who unexpectedly found tares in his field, for he said an enemy had done it. Naturalists may declare that such a change is impossible, that nature is always true to herself, at least that she never takes such an extraordinary and sudden departure, but this frequently fails to convince the farmer. The question has been often discussed, but always reappears after an extremely severe winter.

We have received many letters of inquiry on the subject, and select for publication the following one, which seems to cover the entire ground, and we give in reply such explanation of the case as seems to us in accordance with nature and science:

WASHINGTON, *June* 20, 1883.

BOTANIST OF DEPARTMENT OF AGRICULTURE:

SIR: While in Richland County, Illinois, in May of this year, I became much interested in a subject then being discussed among farmers, viz., the origin of cheat, or chess. There was much difference of opinion concerning certain points, but all appeared to agree as to one fact, viz., that cheat would often come up abundantly in fields where, so far as known, only pure wheat had been sown. From this circumstance, chiefly, had arisen the prevalent belief that under certain conditions, as an unfavorable winter, wheat would "turn to cheat." This opinion appears to be held by a majority of the farmers of the section where I was visiting, and in support of it I have heard related instances where wheat had been cropped by cattle, after which the *identical stalks* had headed out as cheat.

That cheat will sometimes come up in the greatest abundance (occasionally to the almost total exclusion of wheat itself) in fields where only wheat was supposed to have been sown, is a fact which I do not think will admit of any question; but regarding the other aspects of the case, there is much difference among farmers themselves, although those who claim that wheat will turn to cheat are perhaps in the majority.

This being a matter of importance to farmers, and one regarding which they have little knowledge except that derived from their own experience, I have concluded, partly at the request of friends in the country, to ask through you, of the Department of Agriculture, information on this subject, well knowing that the latest and most reliable is to be obtained from this source. With this object in view, I have prepared the following questions, which, if you will kindly answer categorically, you will confer a great favor:

1. Will wheat, under any circumstances whatever, change into cheat, and, if so, what are the conditions?
2. If not, why will cheat come up so abundantly (sometimes almost to the exclusion of wheat itself) in fields where only wheat was sown?
3. Will either wheat or cheat, under any conditions, change to timothy? (This is asserted to be the case by some.)
4. Has cheat a botanical name, and to what cereal is it most nearly related botanically?
5. Is it possible for a head of wheat and another of cheat to grow upon the same stalk, or for a stalk of each to grow upon the same germ?
6. Has the Department of Agriculture ever offered a reward or prize "for a grain

of cheat that would sprout?" (I was informed that a reward of $50 had been offered.)

These questions cover, I believe, the main features of the case, and by answering them at your earliest convenience, you will greatly oblige,

Yours, very truly,

ROBERT RIDGWAY.

REPLY.

SIR: Your letter has been duly received and considered. The subject is an important one, as it relates to a widespread popular error. We have received numerous inquires on this subject, mostly from Illinois, where the wheat has suffered extensively from the last severe winter. The conclusion reached by a large class of farmers, that wheat changes into cheat or chess, must by every intelligent naturalist be considered erroneous. It would be quite as proper to claim that a sparrow would change into a hawk, or an oak into a beech. Still, it must be admitted that there is *apparent* ground for the opinion. The difficulty arises from an imperfect consideration of the facts. As an answer to the questions you propose will elucidate this statement, I will at once proceed to their consideration:

Question 1. To this I reply that under no known circumstances can such a change occur.

Question 2. The reason why cheat comes up abundantly, under such circumstances, is as follows: There is almost always more or less cheat growing in wheat-fields, and consequently there is more or less cheat seed in the ground from self-seeding, as well as from cheat-seed which is, in most cases, mixed in greater or less quantity with seed-wheat, even when great care is taken to clean the seed in the ordinary method. Cheat is of a more hardy nature than wheat, and is much less subject to injury by frost. It always happens that, during a severe winter, a quantity of wheat is destroyed, chiefly in low places, subject to alternate freezing and thawing, by which the roots are broken and exposed by the process of "heaving." In such cases the cheat-plants, being of a more hardy nature, are uninjured, and having the ground now to themselves, grow more vigorously and "stool out" abundantly, so as to take full possession, and then we have a crop of cheat instead of wheat.

Question 3. Such a change is equally impossible with the other, and not any more so, although the absurdity of the case will be more generally admitted.

Question 4. Cheat has a well-known botanical name. It belongs to the genus *Bromus*, and is nearly related to *Festuca* or Fescue grass, and not closely related to any of the common cereals. There are about forty species of *Bromus* in different parts of the world. The species which is commonly known under the name of cheat is *Bromus secalinus*. With this is frequently found two or three other species in the same field. The difference between the close, narrow spike of wheat and the loose, diffusely branched panicle of cheat, or chess, is very great, and a change of one of these to the other would be a great violation of the laws of nature, and without a parallel in either the vegetable or animal kingdoms.

Question 5. A negative reply is the only one that can be given to this question, if the above statements are correct. We have several times had specimens sent to us claiming to be wheat and cheat growing together on the same head, but on examination these proved to be merely a branch of cheat accidentally entangled in the spikelets of a wheat-head. Specimens have also been sent claiming to be wheat and cheat growing on different stalks but from the same root, yet a careful examination showed that the roots of the two plants were closely intermingled without any structural connection.

Question 6. No such reward or prize has been offered. The Department has too much reason to believe that every grain of cheat will sprout under favorable circumstances, and that having sprouted it will struggle for existence and development.

Had these queries come from a spring-wheat section of the country there would probably have been another question of the following character: Why do we not have cheat in spring-wheat fields? The reply to such a question would be that cheat, like winter wheat, begins its growth in the autumn, and, if any existed in the ground prepared for spring wheat, the plowing and harrowing would destroy it or prevent its development.

BERMUDA GRASS FOR HAY.

BERMUDA GRASS (*Cynodon dactylon*) is supposed to be originally derived from India or Eastern Asia, but has long been spread all over the warmer regions of the globe, and is everywhere among civilized people esteemed a valuable forage grass. It has been regarded as a great pest by cotton-planters from the extreme difficulty of its eradication. There

are others who begin to find a profit in its pasturage, and a few who have utilized it profitably for hay. Our statistical correspondent for South Carolina, Mr. L. A. Ransom, thus reports upon this subject:

The peculiar characteristic of this grass is that the stem is either partially or wholly underground and only the leafage above ground. It is low growing, makes a dense sod, and is tenacious of life. When thoroughly set, careful and painstaking work is necessary to eradicate it sufficiently for hoed crops. It can, however, be thoroughly destroyed by such means. It does not in this climate mature its seed, and it is propagated by the root.

The following notes of cultivation of the Bermuda for hay, both on upland and on lowland, are given by Ex-Governor Johnson Hagood:

"The memoranda relative to the upland meadow was furnished me some three years ago by the late Dr. St. Julian Ravenel, of Charleston; the statements relative to the lowland meadow are from my own experience at Saluda Oldtown, in Edgefield County. The hay in Dr. Ravenel's experiments was weighed as taken from the meadow to the barn. The weight given by me is that of the hay when baled for market after undergoing the second fermentation and large reduction in weight which ensues upon storing in the barn. From some experiments, not very accurately made, in ascertaining this shrinkage, I am inclined to think that, allowance being made for it, the product of Dr. Ravenel's highly fertilized upland meadow and that of the Saluda lowland meadow unfertilized, except by river overflow, approximate nearer than the figures given would indicate."

DR. RAVENEL'S UPLAND MEADOW.

The land was sandy, level, dry, without stumps, long since exhausted, and too poor to bring either oats or corn without manure, containing, however, some Bermuda grass roots. It comprises an area of five acres near Charleston, S. C. Five acres of such land, which had been planted and manured for two years, and freed from broom sedge and weeds, was plowed with a two-horse plow on the 1st of May, 1874. A thousand pounds of ash element and two bushels of cow peas were then sown broadcast to the acre; the land harrowed and rolled to make it as smooth as possible.

On the 1st of October there was a heavy growth of pea vines, upon which seed of the native vetch was sown. It germinated quickly, grew all winter, and on the 10th of May was two feet high and very thick. Soon after it seeded profusely, died, and rotted on the ground.

Through this decomposing mass, the Bermuda (*not planted*, but the natural growth, increased by this cultivation) shot up, together with some weeds, which were pulled up.

On the 24th of July, 1875, the first cutting was made, which yielded 2,200 pounds, and on the 8th of October a second cutting yielded 2,900 pounds, altogether 5,100 pounds of well-cured hay to the acre.

Second year.—A thousand pounds of ash element was immediately spread on the stubble (without plowing); a fine growth of vetch followed, occupying the land until the middle of May, and was at once succeeded by Bermuda, which was cut twice, yielding 8,400 pounds per acre of hay as the crop for 1876.

Third year.—The same plan was followed and a good crop taken in 1877, but it was not weighed.

Fourth year.—The crop of 1878 was taken in two cuttings: The first on the 14th of August, weighing, 5,464 pounds; the last 3,600 pounds; together, 9,064 pounds per acre.

Fifth year.—The crop of 1879 was not weighed, but looked as well as that of 1878.

Sixth year.—The winter and spring of 1880 was so dry as to check the grass and delay the first cutting until the 21st of July; there was, however, ample time for another, and the yield was heavy, though not weighed.

The meadow, now nearly seven years old, was in very good condition, with a sod about three inches thick, free from broom sedge and summer weeds.

REMARKS.

1. For the preparation of such a meadow a spot must be chosen where the Bermuda grass naturally appears; unless there is some of it in the land originally the effort to increase it without planting will be vain.

2. Bermuda grass when removed from the soil is very exhausting, and would soon impoverish land whose fertility was not kept up by constant overflow.

3. On poor land the only method which has succeeded in securing and maintaining the necessary fertility at moderate cost is by the use of the two leguminous plants cow-peas and vetch, supplied with as much potash, lime, and phosphoric acid as the grass removes from the land.

4. The native vetch may be found in all parts of this State, and when the land is supplied with the above materials grows vigorously and multiplies with great rapidity.

5. If we assume that the nutritive value of forage is in proportion to the albuminous matter it contains, Bermuda hay compares favorably with that made of other grasses. I have found in some samples as much as 14 per cent.—never less than 11 per cent. Crab-grass cut on a farm near Charleston and carefully cured gave 5.50 per cent.; corn-blades, 9.36 per cent. The Northern hay sold here I do not think would average 8 per cent.

LOWLAND MEADOW.

The land was up-country river swamp, 75 acres near Oldtown, S. C., and the alluvium several feet thick. At usual stage the river is six to ten feet below the level of meadow; at high water all overflowed, no stagnant water, however, at any time on it. When water ran off, the land drained itself well without the aid of ditches. The overflows are frequent in winter, infrequent in summer. This land has been cultivated in corn (no other crop) for 75 or 100 years, and there were few stumps or sprouts in it. No manure had probably ever been applied to it, nor was any applied to it now.

All stumps and sprouts were carefully and thoroughly dug up, or dug around and cut off more than 12 inches below the surface. A few acres were already in the grass, it having been brought down by freshets from higher up the river, and this much of the field had been abandoned for arable culture for from three to five years. The old corn-beds were here leveled by chipping down with the hoe (not a good plan) as plowing would have been better. The additional land desired to be set was then flushed up close and deep with the plow and the Bermuda roots sown freely over it, plowed in shallow and then rolled with a 1,200-pound roller.

THE FIRST YEAR.

A strong and vigorous growth of annual weeds sprung up and soon got ahead of the grass. When these were from one to two feet high they were mown, raked by horse-power and hauled off the land.

The grass now grew rapidly and soon afforded a cutting, but weeds were intermingled with it to an extent that made it unmerchantable hay. It was fed at home. A second harvest was obtained the last of August and first of September, which was first-class hay and free from weeds.

THE SECOND YEAR.

Annual weeds again preceded the grass in growth, but not nearly as thick as the the first year. They were dealt with as before, and two harvests of hay, with a much smaller percentage unmerchantable from weeds, were had.

THE THIRD YEAR.

A few annual weeds appeared, but they were thick enough to need mowing only in spots, and this was done by hand. The first harvest was obtained a month earlier than before, and only one load in forty of hay was unmerchantable from weeds. The annual weeds in subsequent years gave little trouble. They precede the growth of the grass, and allowing a flock of some four or five sheep per acre to graze the meadow until the grass is fairly started was all that was necessary to keep them down.

The cow-itch vine and the broom grass began now to appear on that portion of the meadow which had been longest in the grass. The former was grubbed as it appeared, and when broom grass became troublesome on portions of the meadow so much was plowed, harrowed, and rolled, generally in March. It required four mules to a two-horse Watt plow, with a rolling coulter attachment, to do the plowing, and also extra force to the Scotch harrows, which were heavily weighted to make them tear thoroughly the tenacious furrow slice. This treatment kept the broom grass in check, and seemed to renovate the meadow, improving its yield on these portions after the first next succeeding harvest. The tendency of this grass, like all others cut for hay, is to become sod-bound after a few years, and I am satisfied that a thorough scarification such as would be given by the Chicago Screw Pulverizer, or some similar implement, would be beneficial once in two or three years.

The Bermuda, as has been stated, is a thick and low-growing grass when occupying the land alone, consequently an extra smoothness of the meadow is required for the mower to get the full crop, and the cutting is heavier than other grasses. It was early observed that mingled with a growth of weeds in the struggle for light and air the Bermuda took on a different habit and extended its growth upwards instead of laterally. This led to the attempt to mingle with it a taller grass which would not

deteriorate the quality of the hay. It was necessary to select grasses which did not require annual sowing and which matured, at least for the first cutting, about the same time as the Bermuda. Herds grass, timothy, and red clover fill these conditions. The two first were well adapted to such lands, and, with Red clover, the only doubt was as to the effect of the overflow from the river. Accordingly, in the autumn of the first year, after frost, plots were staked off, and a sowing of each of these grasses was made on the Bermuda. The stubble was burned off first in part of these plots, and in the other part it remained as left by the mower. A harrow was run over it when the land was moist, and after sowing the harrow was again used.

The catch was excellent with each of the grasses, and the next spring the following results were shown: While with all the object was obtained of giving the upward development to the Bermuda, the timothy and herds grass struggled with it for possession of the soil, the Bermuda having the best of the fight, and the yield of the hay was increased to no very great extent. With the red clover, however, the case was different. It and the Bermuda each grew as if it was planted alone, and the mass of grass upon the land was apparently doubled. The reason was evident. Timothy and herds grass, like the Bermuda, were surface rooted and fed upon the same area of soil, while the tap-rooted clover, going below the Bermuda, drew its sustenance from a different but equally rich stratum of alluvium. It was like superimposing one meadow upon another and doubling the producing area. The winter freshets have shown that at that period of its growth the clover is not damaged by them. These freshets, several times during each winter, cover the meadow with slow-moving back water from three to ten days at a time. One objection is found, however, to the use of clover in combination with Bermuda. The first cutting is excellent hay, but the second cutting is only fit for cattle, there being sufficient clover in it, mixed with the Bermuda, to make the hay salivate horses.

The whole meadow of 75 acres was not set out in one year. About 45 acres, including what was already in the grass, was the the work of the first year, and the meadow was extended annually for the next three years until its present area was reached. The yield of these several extensions was carefully noted from harvest to harvest, and the following is the average result: The first year about 3,000 pounds hay per acre; the second year and afterward from 4,000 to 6,000 pounds; the last year, being the fifth, the whole meadow promised to yield fully the last-mentioned amount, but the second and most valuable cutting was entirely lost by a summer freshet just as the mowers were put to work.

I think an average of from 4,000 to 5,000 pounds is what may be safely calculated upon in a series of years, according to seasons and including the damage of the occasional summer overflows.

The cost of establishing the meadow was about $8 per acre. The cost of mowing and putting hay in barn about $2 per ton. This of course does not cover all the expenses of making and selling a ton of hay, but is mentioned because of the novelty of that kind of work to many in this section. The sales of the hay baled and delivered on the cars at my railroad station has ranged from $20 to $25 per ton, and it has met with as ready sale as beef, mutton, cotton, or any other product of the farm.

DESCRIPTION OF GRASSES.

PANICUM JUMENTORUM—*Guinea grass.*

A large, vigorous, perennial grass, attaining in good soil a height of from 6 to 10 feet; the leaves are 1 to 2 feet long and frequently an inch or more wide, rough on the edges, and with a few scattered hairs on the surface; the sheath is long, and nearly smooth except near the joints, which are soft-hairy. The panicle is from 1 to 1½ feet long and diffusely branched, the upper branches single and 3 to 4 inches long, the lower ones two to five together at the joints and 6 to 10 inches long; the flowers are scattered along the rather slender branches nearly the whole length on slender, rather short pedicels. The spikelets are about 1½ lines long, smooth and rather acute pointed; the lowest glume is about one-third the length of the spikelet, the second glume is slightly longer than the perfect flower, and five to seven nerved. As in the genus generally, there are two flowers in each spikelet, the lower one of thin texture with stamens only, the upper one perfect and much thicker; the flowering glume of the lower flower is about five nerved, the palet two nerved, hyaline, as long as its glume; the perfect flower is finely wrinkled transversely.

This grass is a native of Africa, but has been introduced into many tropical countries, and in the West Indies, particularly, is extensively cultivated for pasturage. It is very prolific and may be cut several times in a season. It has been introduced in Florida, and deserves to be more extensively cultivated. It has been confounded with the Johnson grass, which is very different, and is botanically *Sorghum halapense.* PLATE I. *Fig. a, spikelet.*

PANICUM MOLLE—*Para grass.*

This is quite similar in general appearance to the preceding (Guinea grass), but has smaller leaves and a shorter, less spreading pannicle with shorter branches. The spikelets are closer together and are very short pediceled; the lowest glume is shorter, being about one-fourth as long as the spikelet. In other respects the flowers can hardly be distinguished.

This species is also said to be a native of Africa. It has been introduced into South America, and in Brazil is largely cultivated for pasturage, and is said to be unequaled for the quantity and quality of the feed which it produces.

The figure given on Plate II is from a specimen grown at Mobile, Ala., furnished by Dr. Charles Mohr, who states that it has been some years introduced in that vicinity, and that it is extremely productive and valuable. PLATE II. *Fig. a, spikelet.*

PASPALUM SETACEUM.

Grows in patches, with slender culms about 2 feet high, with usually two slender linear spikes 2 to 3 inches long, near together at the summit, and one or two lateral ones from lower joints on long slender peduncles. The spikelets are very numerous, in pairs in two or three rows on the two sides of a slender rhachis. The spikelets are one flowered, about a line long, ovate and blunt. The two outer glumes are thin, three nerved, smooth or sometimes roughish, with short, scattered hairs. The fertile flower is convex on one side and flat on the other, the flowering glume and its palet both of thick hard texture and inclosing the small seed. There are several varieties, some with narrow and some with broad leaves, some smooth and some hairy. It is not generally considered a valuable grass, but it grows abundantly in sandy soil from New Jersey to Florida, and westward, and in such places furnishes a good deal of forage, and grows during the hottest and driest seasons. PLATE III. *Fig. a, spikelets.*

ZIZANIA AQUATICA—*Wild rice—Indian rice.*

This grass has some botanical relationship to the common commercial rice (*Oryza sativa*), but is very different in general appearance. It is widely diffused over North America, and is found in Eastern Siberia and Japan. It grows on the muddy banks of rivers and lakes, both near the sea and far inland, sometimes in water 10 feet or more deep, forming patches or meadows covering many acres, or extending for miles. Its ordinary growth is from 6 to 10 feet high, with a thick, spongy stem and abundant long and broad leaves. The panicle is pyramidal in shape, 1 to 2 feet long, and widely branching below. The upper branches are rather appressed and contain the fertile flowers, and the lower branches contain only staminate ones. The spikelets are one-

flowered, each with one pair of husk leaves, which are by some botanists called glumes and by others called palets. These husks or glumes in the fertile flowers are nearly or quite an inch long, with an awn or beard as long or twice as long. The enclosed grain is half an inch long, slender and cylindrical. The glumes of the staminate flowers are about $\frac{1}{2}$ an inch long and without awns, each flower containing six stamens. These flowers fall off soon after they expand. The fertile flowers also drop very readily as soon as the grain is ripened. The grass abounds in the small lakes of Minnesota and the Northwest, and is there gathered by the Indians for food. The husk is removed by scorching with fire. It is a very palatable and nutritious grain. Some attempts have been made at the cultivation of the grass, but the readiness of the seed to drop must interfere with a successful result. Near the sea-coast multitudes of reed-birds resort to the marshes, where it grows, and fatten upon its grain. The culms are very sweet and nutritious, and cattle are said to be very fond of the grass. PLATE IV. *Fig. a, male spikelet; b, female spikelet.*

HILARIA JAMESII.

This grass was formerly called *Pleuraphis Jamesii*, but has recently been united to the genus Hilaria. It is a native of the arid regions extending from Mexico to Colorado, growing in clumps from strong scaly runners or rhizomas. The base of the culm is usually covered with the dried leaves of the preceding year. The culms are from 1 to $1\frac{1}{2}$ feet high, with a few, short, rigid, light green or bluish-green leaves which are more or less involute. Each culm is terminated by a simple, loose spike, 1 to 2 inches long, with alternate clusters of sessile spikelets. These clusters are quite complex in structure, each one containing three spikelets, one central and two lateral. The central spikelet consists of a single fertile flower, and the lateral spikelets each of two male flowers. The lower glume in each lateral spikelet is awned about the middle. The two outer glumes of the central spikelet are bifid or two lobed, strongly nerved, and with the nerves extended into awns reaching beyond the apex of the glume. PLATE V. *Fig. a, spikelet.*

ANDROPOGON VIRGINICUS—*Broom grass.*

Several species of broom grass have been figured in previous reports. The one here named has an extended range on the eastern part of the continent, growing in a great variety of soils and situations, but mostly on dry hills, abandoned fields, or stony woods. The culms are from 2 to 4 feet high, and very leafy, the leaves in two ranks at the base, smooth except a few long hairs on the margins and at the throat of the sheath. The panicle is long, narrow and leafy, 1 to 2 feet long, composed of numerous lateral branches from the upper joints. These branches are several times subdivided and partly inclosed in the long leaf sheath, each ultimate sheath or bract inclosing usually a pair of loose, slender flower spikes. These spikes are about 1 inch long, comprising ten or twelve joints, each joint giving rise to one sessile fertile spikelet, and a hairy pedicel longer than the fertile flower, at the summit of which there is a vestige of a flower or a mere bristle-like point. The fertile spikelets are one flowered, and consist of two outer thickish glumes and two thin transparent inner ones, one of which has a slender awn three or four times its own length; the upper one is by some considered as a palet, and is not awned.

The broom grasses to be made useful must be kept from running up

to flower, the stems being tough and indigestible, but by close pasturing they are said to make excellent and permanent pastures. PLATE VI. *Fig. a, spikelet.*

PHALARIS ARUNDINACEA—*Reed Canary grass.*

A perennial grass with strong, creeping rhizomas, growing from 2 to 5 feet high, usually in low or wet ground. It ranges from New England and New York westward to Oregon, and northward in Canada. It is common also in the north of Europe. The culm is stout, smooth and leafy; the leaves are mostly from 6 to 10 inches long and about half an inch wide, the upper ones shorter. The ligule is about 2 lines long, rounded or obtuse. The panicle is from 2 to 4 inches long, narrow and spike-like, the branches short and crowded above, rather distant below, slightly spreading when in flower; the spikelets are one flowered, each flower having at its base a pair of small heavy scales or rudimentary flowers. The outer glumes are nearly equal, somewhat boat-shaped, oblong-lanceolate, 2 to 2½ lines long, acutish, three nerved, the keel scabrous and slightly thickened near the apex. The flowering glume is somewhat shorter than the outer ones, ovate, somewhat hairy externally; the palet is of about the same length and lanceolate.

The common ribbon-grass of the gardens is a variety of this grass, and that which furnishes the canary seed of commerce is a species of the same genus. It is said to be extensively used for fodder in Sweden, but that in this country cattle do not like it, although chemical analysis shows that it contains a large amount of nutritious elements. PLATE VII. *Fig. a, spikelet.*

ARISTIDA BROMOIDES—*Poverty grass.*

A small, apparently annual grass, growing in the arid districts of New Mexico, Arizona, and Southern California. It grows in tufts, many culms from one root. The culms are from 6 to 12 inches high, slender, erect, or somewhat bent at the lower joints, unbranched. The leaves are few, short, involute, and bristle-like, 1 to 3 inches long. The panicle is 2 or 3 inches long, narrow, and open or loose, the short alternate branches erect, below mostly in pairs, one of which is shorter than the other. The spikelets are one flowered, 7 or 8 lines long, including the awns; the outer glumes are membranaceous, acute, purple, one nerved, the lower about 2 lines and the upper about 3 lines long; the flowering glume is narrowly cylindrical, purple blotched, smooth except the scabrous midnerve, 3 lines long, terminated by three erect, slightly diverging, roughish awns, the middle one nearly 4 lines long, the two lateral ones about 3 lines long; it has a short pubescent stipe or callus at the base, and is closely rolled about the palet, which is very narrow and rather shorter than its glume. The grass is apparently of little or no agricultural value. PLATE VIII. *Fig. a, spikelet.*

STIPA VIRIDULA.

Culms 2 to 4 feet high, leafy; the radical leaves 1 to 1½ feet long, cauline 4 to 10 inches long, 1 to 2 lines wide, involute and bristle-like at the point; sheaths long, smooth, the uppermost inclosing the base of the panicle; panicle very variable in size, from 6 inches to a foot or more, narrow and loose, variable in thickness, the branches mostly in twos or threes, erect and appressed, much subdivided; spikelets one flowered on short pedicels; outer glumes 4 to 6 lines long, bristle-pointed,

nearly equal, lanceolate or ovate-lanceolate, three to five nerved, thin; flowering glume nearly cylindrical, 3 to 4 lines long, with a short, thick callus at the base, covered with short scattered hairs which are longer at the apex, minutely two toothed, the apex terminated by a slender awn 1 to 1½ inches long, once or twice bent, twisted and sparsely pubescent below, scabrous above; the palet is narrow and shorter than its glume, and with the stamens and style is closely involved by the glume.

Widely diffused over the region west of the Mississippi, extending to California, Oregon, and British America, furnishing a part of the wild forage of the region. PLATE IX. *Fig. a, spikelet.*

MUHLENBERGIA GRACILIS.

A perennial grass growing in tufts or loose patches from a creeping root-stock, much branched at the base; culms erect, slender, and wiry, 1 to 1½ feet high, leaves mostly radical, involute, and bristle-like, 2 to 6 inches long, scabrous on the edges; panicle erect or somewhat nodding, 3 to 6 inches long, narrow, very loose, the branches rather distant, solitary, erect; spikelets one flowered on short pedicels; outer glumes unequal, 1 to 1½ lines long, the lower one, one nerved and ending abruptly in a slender point, the upper one, three nerved, three toothed above, the teeth usually prolonged into short awns; flowering glume 1½ to 2 lines long, somewhat cylindrical, tapering to a point, sparsely rough pubescent, at the apex extended into a straight awn about ½ an inch long; palet as long as the flowering glume with the awn. Inhabits the arid regions of Colorado, New Mexico, and Arizona. PLATE X. *Fig. a, spikelet.*

SPOROBOLUS AIROIDES—*Salt grass.*

Culms arising from strong perennial root-stocks, 2 to 3 feet high, thickened at the base and clothed with numerous long, rigid, generally involute, long-pointed leaves, which are smooth, and *bearded* in the throat of the sheath; panicle becoming exserted and diffuse, 6 to 12 inches long, 3 to 4 wide, the branches scattered, mostly single, or verticillate below, the branchlets capillary; spikelets one flowered, purplish, on slender pedicels; outer glumes unequal, thin, nerveless or obscurely nerved, oblong, the lower half as long as the upper, the upper, rather shorter than the flowering glume, which is about 1 line long, oblong or lance-oblong, obtusish or minutely dentate at the apex; palet about equal to its glume, bidentate.

A common grass throughout the arid regions of the great West, sometimes called salt grass, and affording considerable pasturage in some places. PLATE XI. *Fig. a, spikelet.*

SPOROBOLUS CRYPTANDRUS.

An annual grass, some forms of which have much the appearance of the preceding species, but of a darker green color, shorter and less rigid leaves, and the panicle usually long and narrow, much of it concealed in the sheathing leaf, the branches shorter and appressed, the glumes narrower and more pointed. It prevails not only in the West, but extensively at the East and South. PLATE XII. *Fig. a, spikelet.*

AGROSTIS CANINA—*Dog's bent grass.*

A grass usually of low size, 6 to 12 inches high, with slender culms, and a light flexible panicle, growing in elevated regions or in high lati-

tudes, and with a perplexing variety of forms. The radical leaves are numerous, but short and narrow. The culm has about 2 fine short leaves, 1 or 2 inches long, the ligule acute, short, but conspicuous. The panicle is pyramidal in form, 3 or 4 inches long, of few capillary branches which are mostly in pairs, horizontal in flower, more erect and close in fruit, dividing near the extremities into a few sparsely-flowered branchlets. Spikelets one flowered, on short, fine pedicels; the outer glumes are ovate and acute, nearly equal, the lower one slightly the longer, 1 to 1½ lines long; the flowering glume is about a quarter shorter than the outer glumes, thin, smooth, obtuse, and bearing on the back, about the middle, a fine, straight awn about 2 lines long; the palet is so minute as to be hardly visible to the naked eye. There are several varieties of this grass growing in mountainous regions throughout the United States and in Europe. It forms a close sod, and affords considerable pasturage in such regions. PLATE XIII. *Fig. a, spikelet.*

CALAMAGROSTIS (DEYEUXIA) HOWELLII.

Culms densely tufted, 1 to 2 feet high, erect or somewhat geniculate below, smooth; radical leaves inclined to be involute, firm but not rigid, in length equaling or exceeding the culm, ligule conspicuous, about 1½ lines long, scarious; culm with 3 or 4 leaves which are 4 to 6 inches long, the upper one nearly equaling the culm. Panicle pyramidal, loose, and spreading, 3 to 4 inches long, rays mostly in fives, the lower 1 to 1½ inches long, numerously flowered above the middle; spikelets single flowered with a hairy rudiment, pale green or tinged with purple; outer glumes lanceolate, acute, 2½ to 3 lines long, nearly equal, membranaceous, the upper three nerved, the lower one nerved; flowering glume slightly shorter than the outer ones, lanceolate, acute, three to five nerved, the apex bifid, usually with 4 mucronate points, a conspicuous, strong awn, ½ an inch long, inserted on the back about the lower third, a tuft of short hairs and a hairy pedicel at the base, about half as long as the floret; palet nearly as long as its glume, thin, acute, two-toothed.

This grass has been recently discovered in Oregon, by Mr. T. J. Howell, and also in Washington Territory, by Mr. W. N. Suksdorf. From its habit of growth and the great abundance of foliage it gives promise of being a valuable grass for cultivation. PLATE XIV. *Fig. a, spikelet; b, flower.*

TRISETUM PALUSTRE.

A slender grass usually about 2 feet high, growing in low meadows or moist ground throughout the eastern part of the United States. The culms are smooth with long internodes and few linear leaves 2 to 4 inches long; with a short, toothed ligule; the panicle is oblong, 3 to 4 inches long, loose, and gracefully bending, the rays two to five together, rather capillary, 1 to 1½ inches long, loosely flowered; the spikelets have two flowers and a naked pedicel supporting a small rudimentary third flower; the outer glumes are about 2 lines long, acute, and scarious margined, the lower, lanceolate and one nerved, the upper, rather obovate and three nerved; the lower flower is 2 lines long and awnless, or sometimes tipped with a short awn; the second flower is rather shorter, with two acute teeth at the apex and on the back, *about the upper third* a slender spreading or bent awn longer than the flower; the palets are about a third shorter than their glumes, very thin, bifid at the apex.

This grass is seldom found in sufficient quantity to be of much value. PLATE XV. *Fig. a, spikelet; b, single flower.*

DANTHONIA SERICEA.

A perennial grass, 2 to 3 feet high, growing in open, sandy woods, with numerous long, slender radical leaves, and three to four similar cauline ones, the sheaths soft hairy, the ligule a mere hairy fringe; culms smooth, flexible; panicle open, 3 to 4 inches long; the rays single at the joints, subdivided from the lower third into a few branchlets, each with one to three spikelets; spikelets about seven flowered, the flowers closely packed and silky hairy; outer glumes smooth, half an inch or more long, longer than all the flowers in the spikelet, linear-lanceolate, the lower two and the upper three nerved; the flowering glumes are about 3 lines long, five to seven nerved, tipped with two slender, awl-pointed teeth, between which is produced a stiff awn, 5 or 6 lines long, which below is broadly flattened and twisted; the flowering glume is sparsely hairy on the back, and copiously white silky on the margins below; the palets are shorter, thin, pubescent on the two nerves. This species appears to be mainly confined to the Atlantic States. Its value has not been tested. PLATE XVI. *Fig. a, spikelet.*

SPARTINA JUNCEA.—*Marsh grass.*

A rigid perennial grass, usually about 1 to 2 feet high, from a creeping scaly rhizoma; leaves involute, rush-like, and rigid; panicle composed of three to five linear, alternate, shortly peduncled, spreading spikes, 1 to 2 inches long, and 1 inch or more distant on the culm. The spikes are crowded with the one flowered spikelets, which are arranged in two rows on one side of the rhachis. The outer glumes are very unequal, acute, the upper one linear-lanceolate, strongly compressed and keeled, 4 or 5 lines long, the margins membranaceous, the middle thick, and the keel scabrous; the lower one is less than half as long as the upper, narrow and thin; the flowering glume is about 4 lines long, lanceolate, obtuse, membranaceous, compressed, and with a thick midrib, which is roughish near the apex; the palet is thin, as broad and somewhat longer than its glume.

This grass forms a large portion of the salt marshes near the seacoast. It forms an inferior hay called salt hay, which is worth about half as much per ton as timothy and red top. PLATE XVII. *Fig. a, spikelet.*

CHLORIS ALBA.

An annual grass, growing in tufts, 1 to 2 feet high, smooth, the culms simple or branched, frequently bent at the lower joints and decumbent, becoming erect; leaves numerous, smooth, sheaths mostly loose, blade broadish, the upper sheath dilated, and at first inclosing the flower spikes, which are eight to fifteen in number, 2 to 3 inches long, umbellate or fasciculate at the top of the culm or of the lateral branches. The spikelets are sessile and crowded in two rows on one side of the spikes; each spikelet contains one perfect and one or two imperfect or rudimentary flowers; the glumes are unequal, thin, both mucronate or short-awned, the lower one oblong, 1 line long, the upper lanceolate, about 1½ lines long; the flowering glume of the lower or perfect flower is thicker than the outer glumes, about 1½ lines long, broad in the mid-

dle and narrowed above and below, much compressed, obscurely three-nerved, with two short teeth at the apex and a straight awn 2 or 3 lines long between the teeth, the margins toward the top ciliate with long white hairs; the palet is narrow, of similar texture and nearly as long as its glume; the neutral or upper flower is shorter, truncate above, tipped with an awn, and without palet or stamens; sometimes there is another smaller rudimentary flower or pedicel above the second. A common grass in the arid regions from New Mexico south and west PLATE XVIII. *Fig. a, outer glumes; b, perfect flower; c, sterile flower*

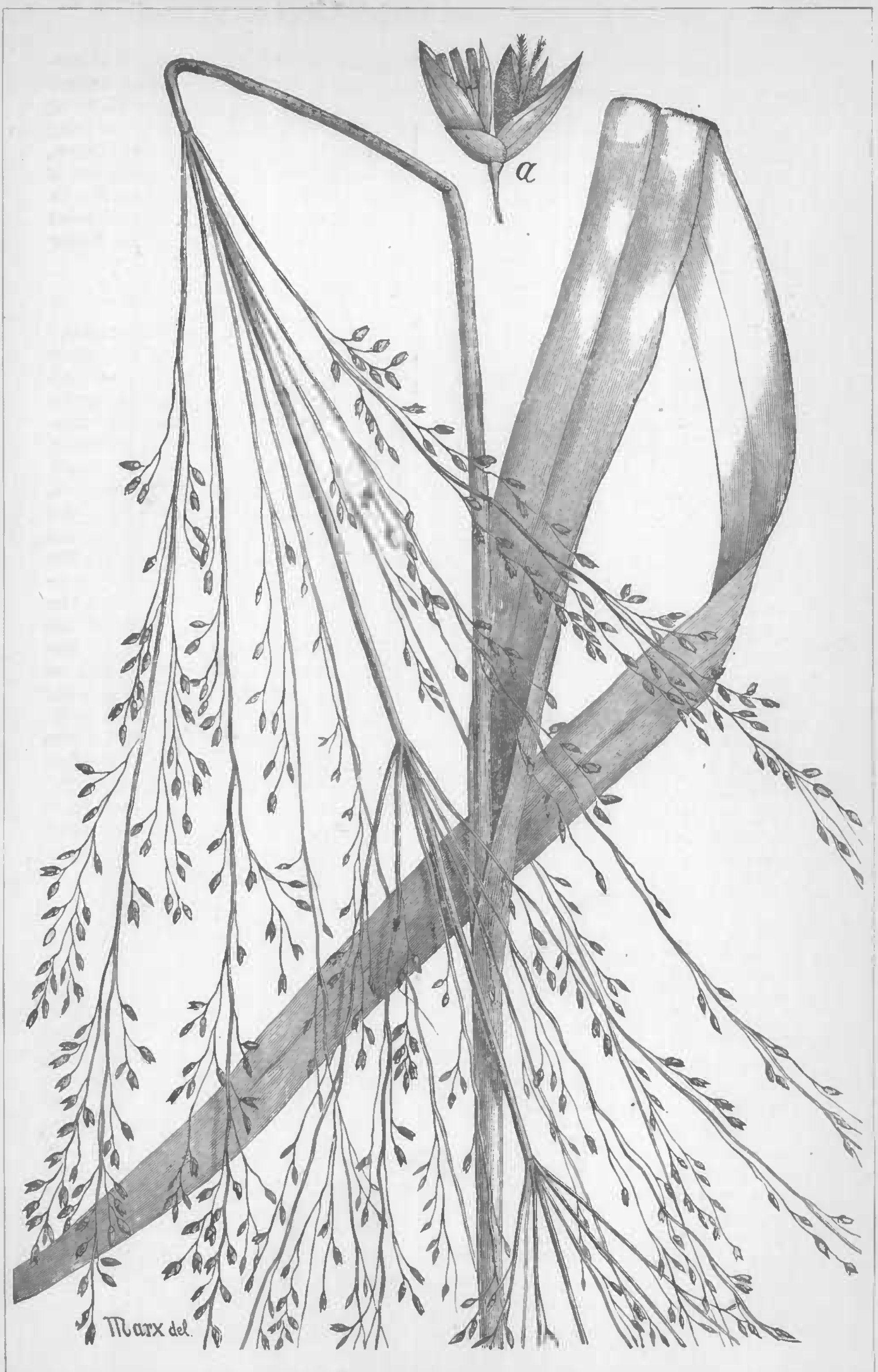
BOUTELOUA POLYSTACHYA.—*Low gramma grass.*

This is one of the many species called gramma in the arid districts o Texas, New Mexico, and Arizona. It is an annual, from 6 to 12 inches high, growing in clumps, the culms branching, geniculate below, ascending and smooth. The leaves are short, 1 to 2 inches long, numerous, the sheaths somewhat compressed, the ligule ciliate. The culm terminates in a raceme 3 to 6 inches long, composed of five to seven alternate, one-sided spikes; which are about 1 inch long, and half to an inch apart. The spikelets are close together in two rows on one side of the rhachis, each containing one perfect and one or two rudimentary flowers; the outer glumes are thin, unequal, oblong, bifid, and mucronate at the apex, the lower, half a line, the upper, about 1 line long, and purple; the flowering glume of the lower or perfect flower is oblong obtuse, two-thirds of a line long, three nerved (the nerves extended beyond the glume into short awns), with two broad lobes, one on each side of the central awn, and two small lateral lobes, one on each outer side of the lateral awns, the outer margins densely ciliate; the palet is as long as its glume, narrower, four toothed at the apex, two nerved, and shortly two awned; the rudimentary flower is shorter, elevated on a short pedicel, dividing at the summit into three awns, with three small glume-like scales, and a second minute rudiment. There are two or three varieties of this grass, the typical one being smaller in every respect than the one here described. Near the banks of streams where it abounds it furnishes excellent pasturage. PLATE XIX. *Fig. a, spikelet; b, outer glumes; c, fl. glume; d, palet and fl.; e, rud. flower.*

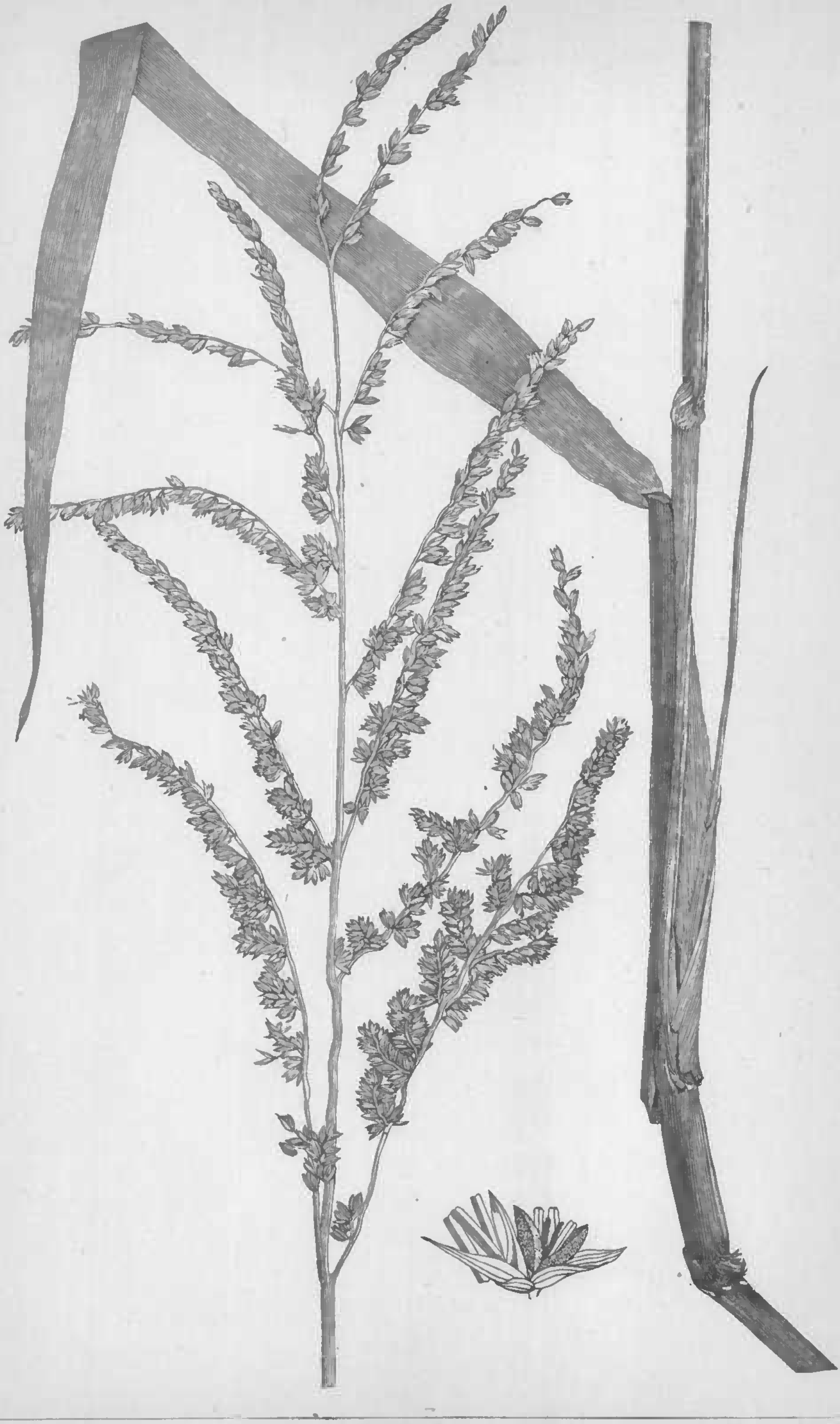
TRICUSPIS (TRIODIA) ACUMINATA.

A low species, growing in tufts from 6 to 12 inches high, spreading by slender runners, the leaves short and narrow, but abundant at the bottom; the culms are slender, erect, with one or two short leaves, terminated by an oblong spike-like panicle about 1 inch long, composed of a few crowded, sessile or nearly sessile branches, each with one to three spikelets. The spikelets each contain eight to ten crowded flowers. The outer glumes are nearly equal, lanceolate, acute, chartaceous, one nerved, the upper 3 lines long, the lower a quarter shorter; the flowering glumes are about 3 lines long, lanceolate or ovate lanceolate, acute, three nerved, the mid nerve extended into a short, stiff awn, the margins fringed the whole length with long white hairs, and the back near the base very hairy, as is also the rhachis; the palet is about two-thirds as long as its glume, folded back on the two nerves, sparingly hairy, and the nerves scabrous pubescent.

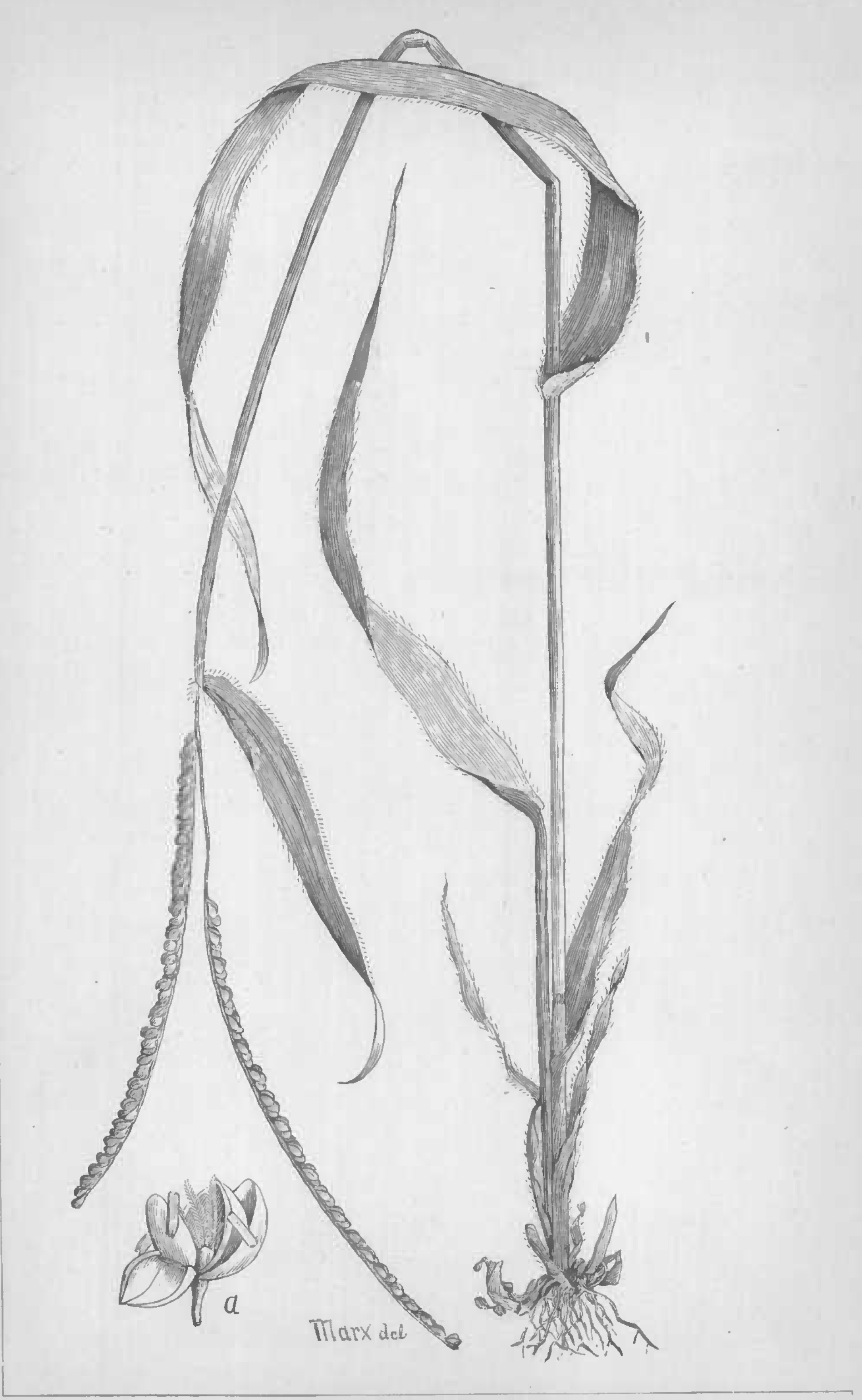
A native of the arid regions of Texas, New Mexico, southward and westward. PLATE XX. *Fig. a, outer glumes; b, single flower.*



Panicum jumentorum.



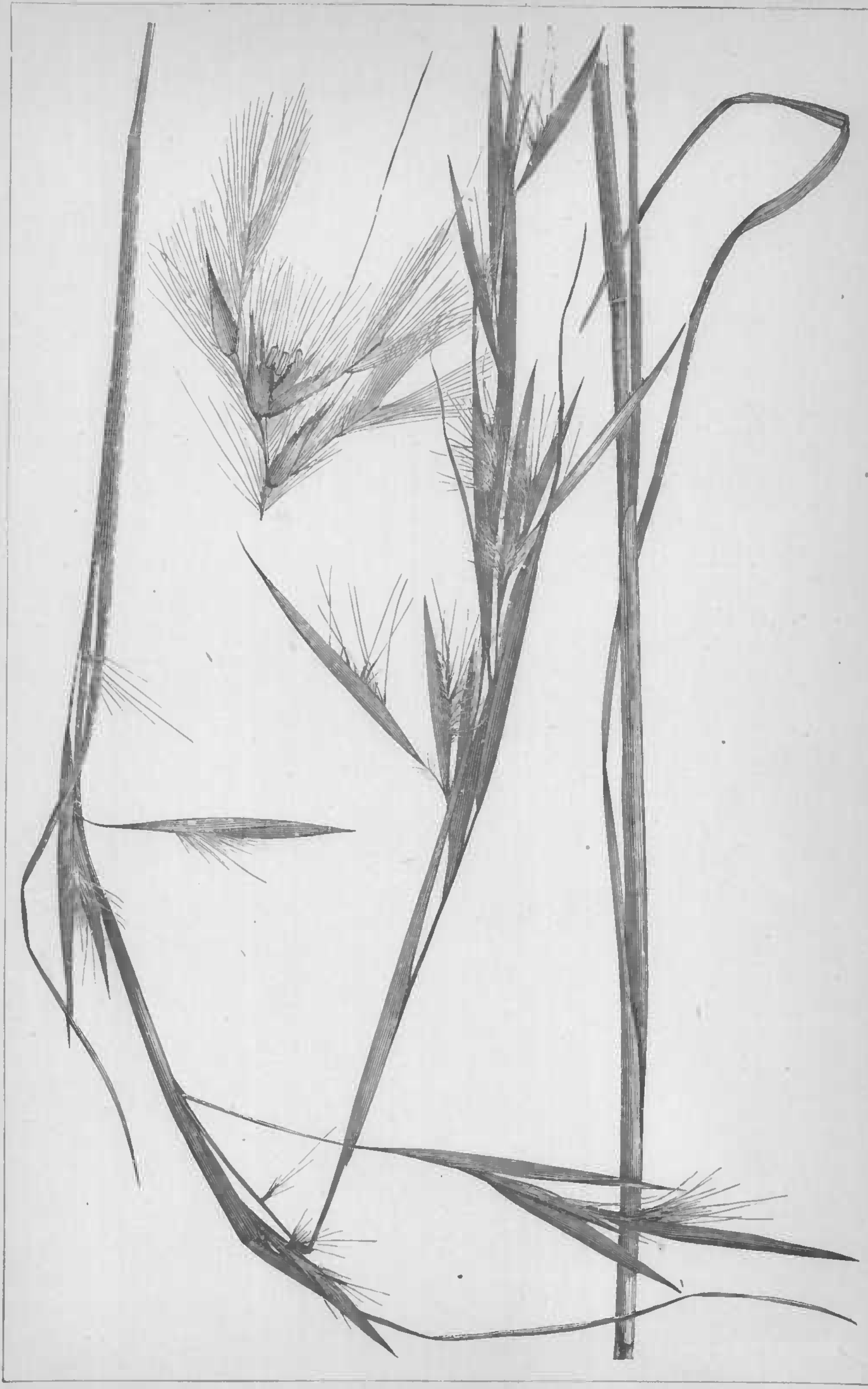
PANICUM MOLLE.



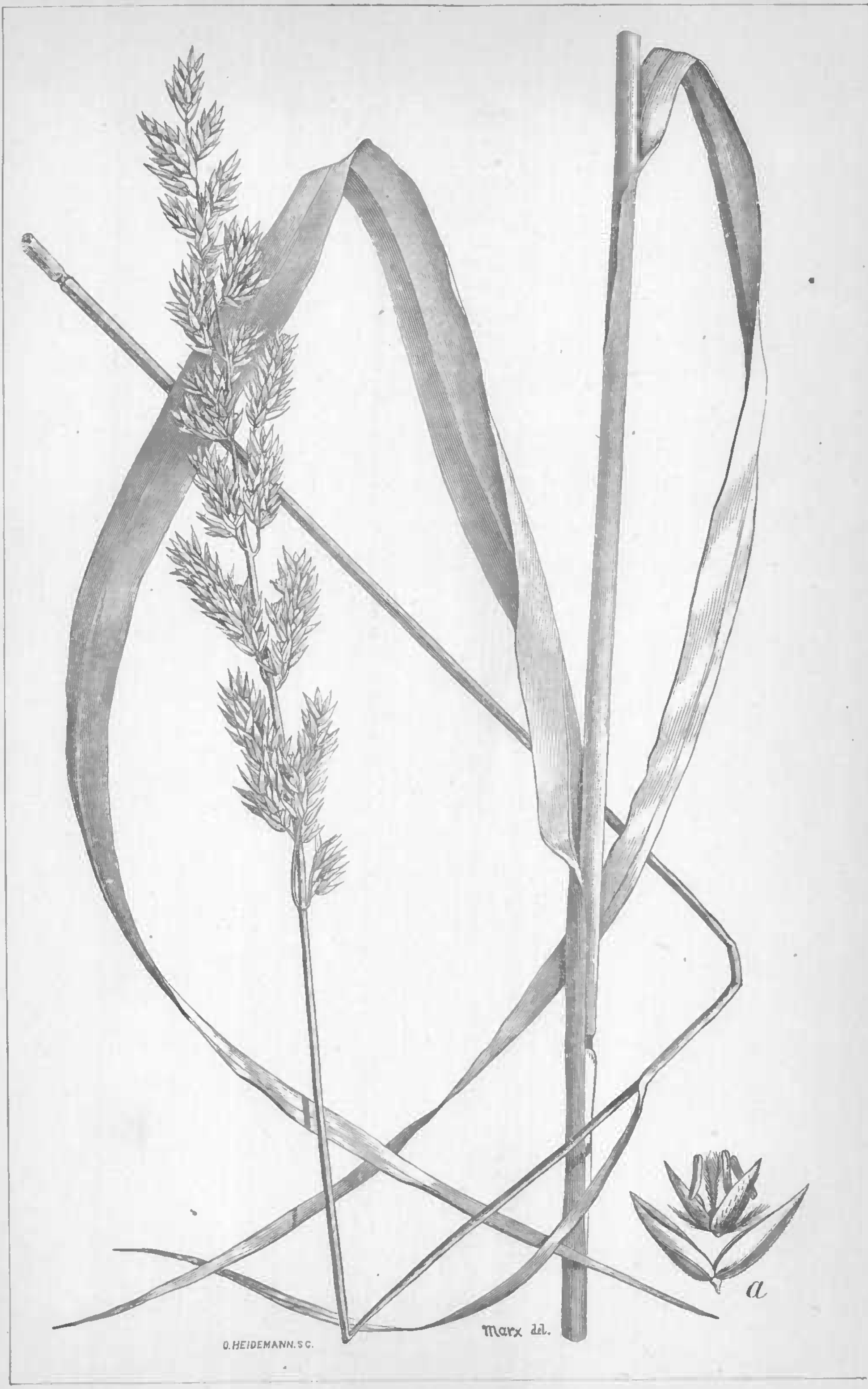
PASPALUM SETACEUM.

ZIZANIA AQUATICA.

HILARIA JAMESII.



ANDROPOGON VIRGINICUS.

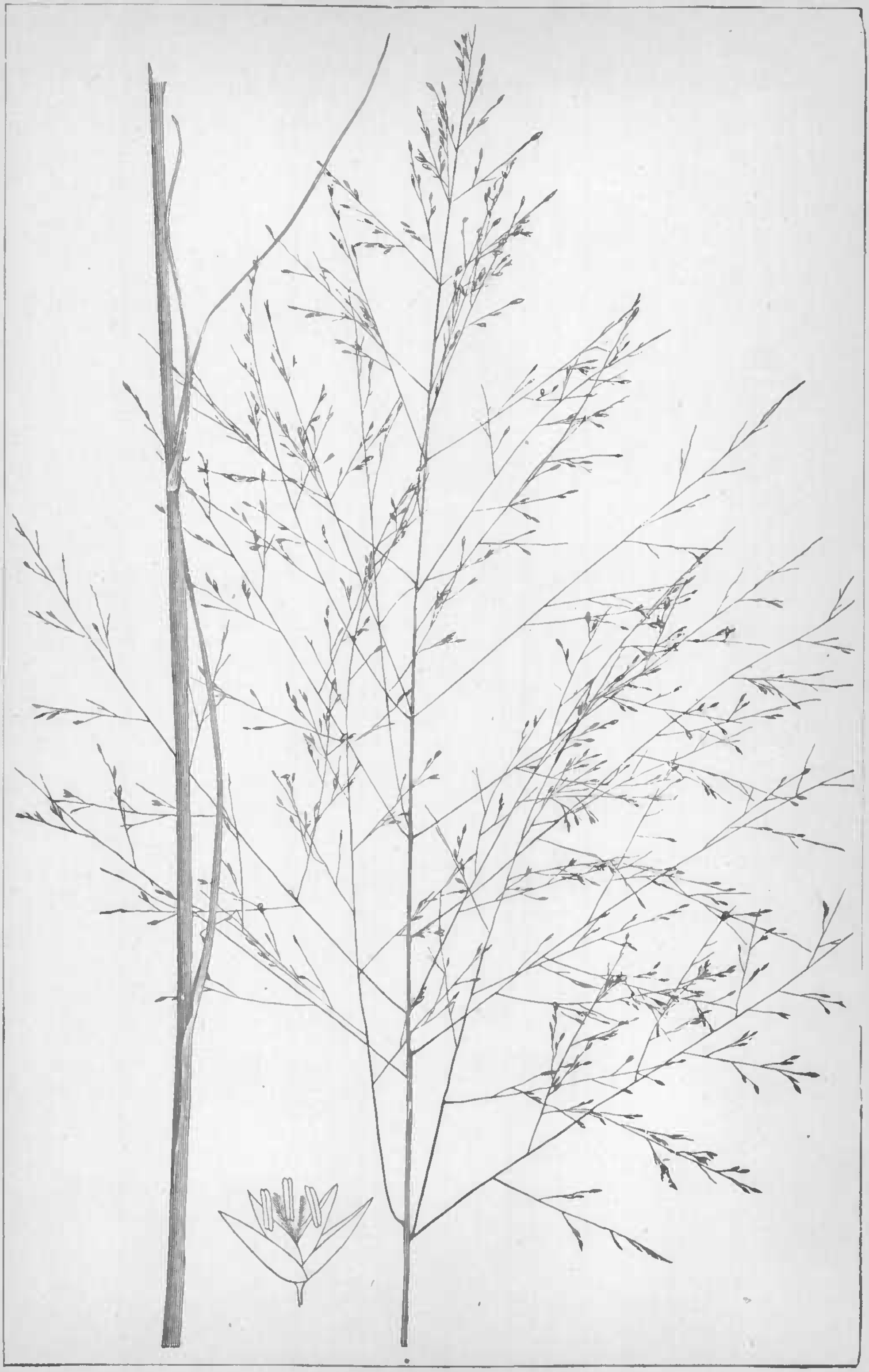


PHALARIS ARUNDINACEA.

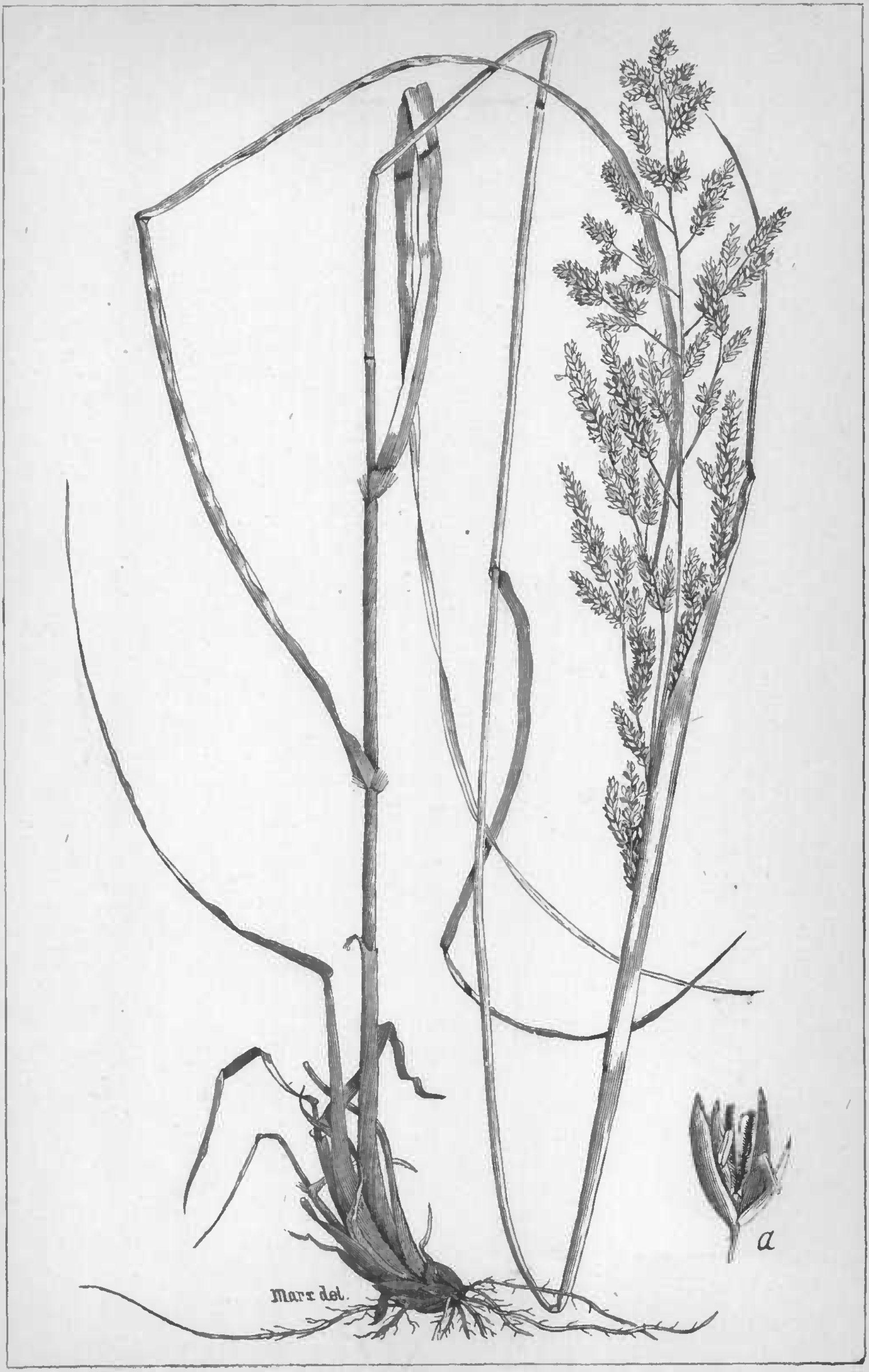
ARISTIDA BROMOIDES.

STIPA VIRIDULA.

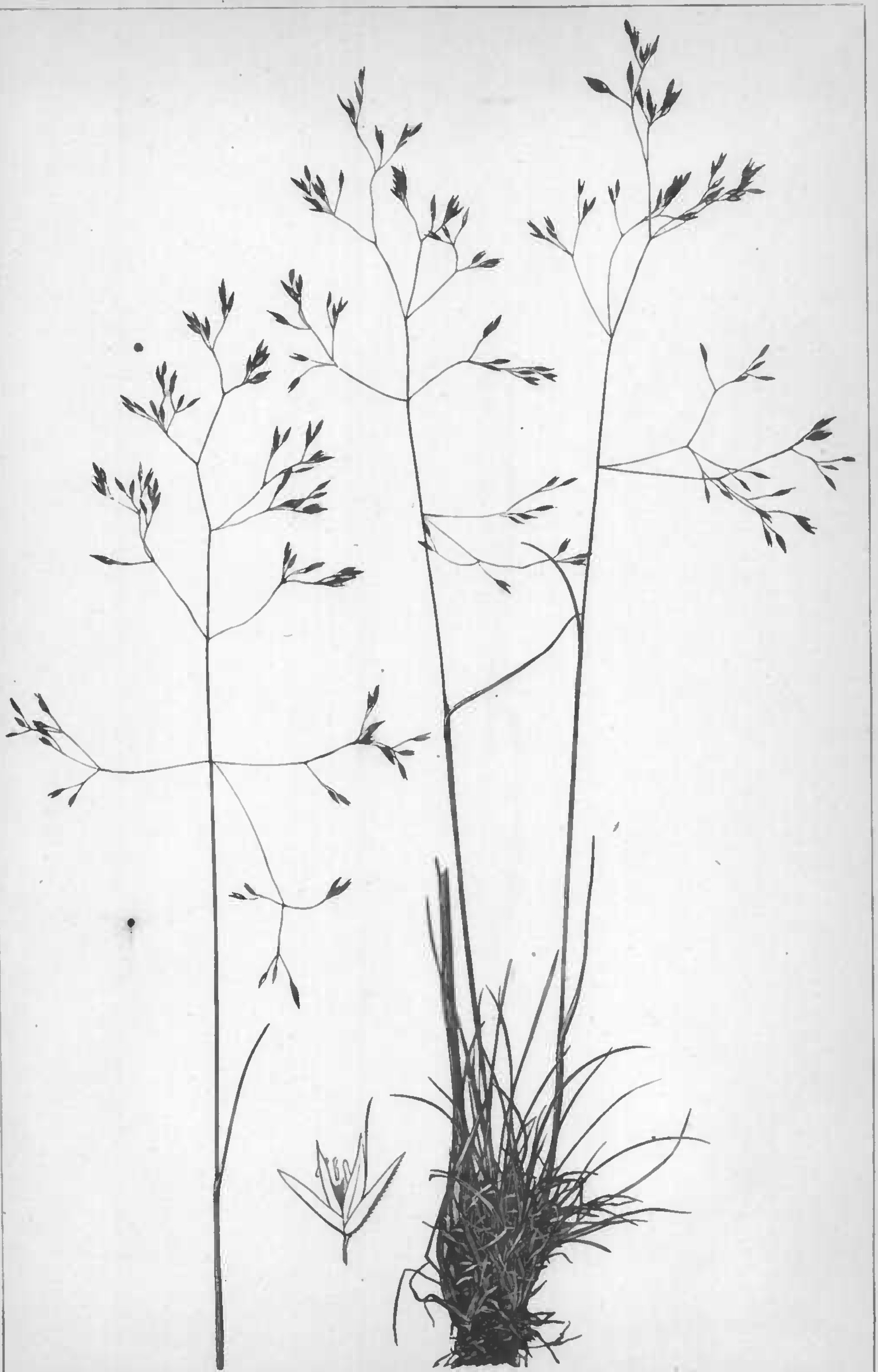
MUHLENBERGIA GRACILIS.



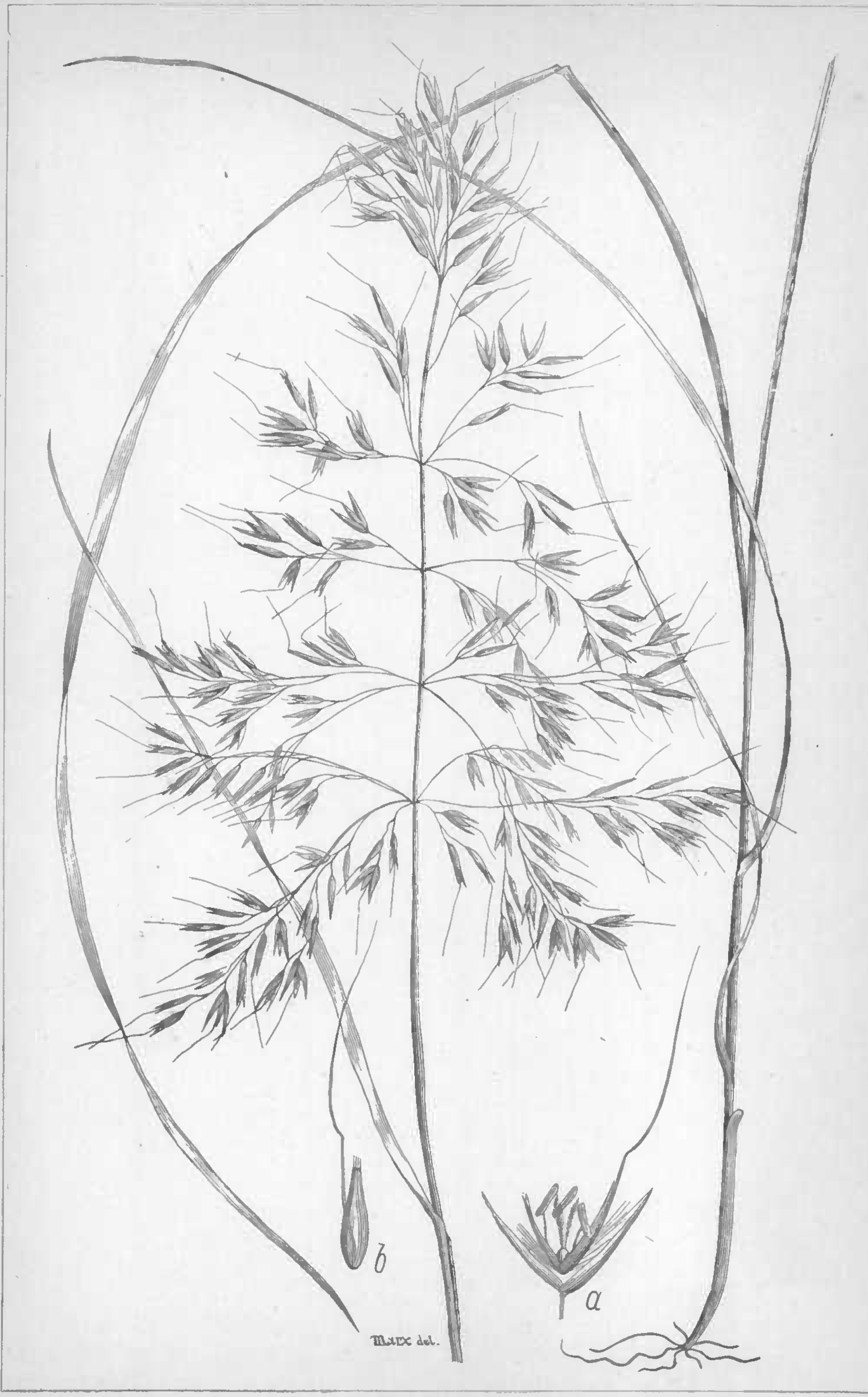
SPOROBOLUS AIROIDES.



SPOROBOLUS CRYPTANDRUS.



AGROSTIS CANINA.



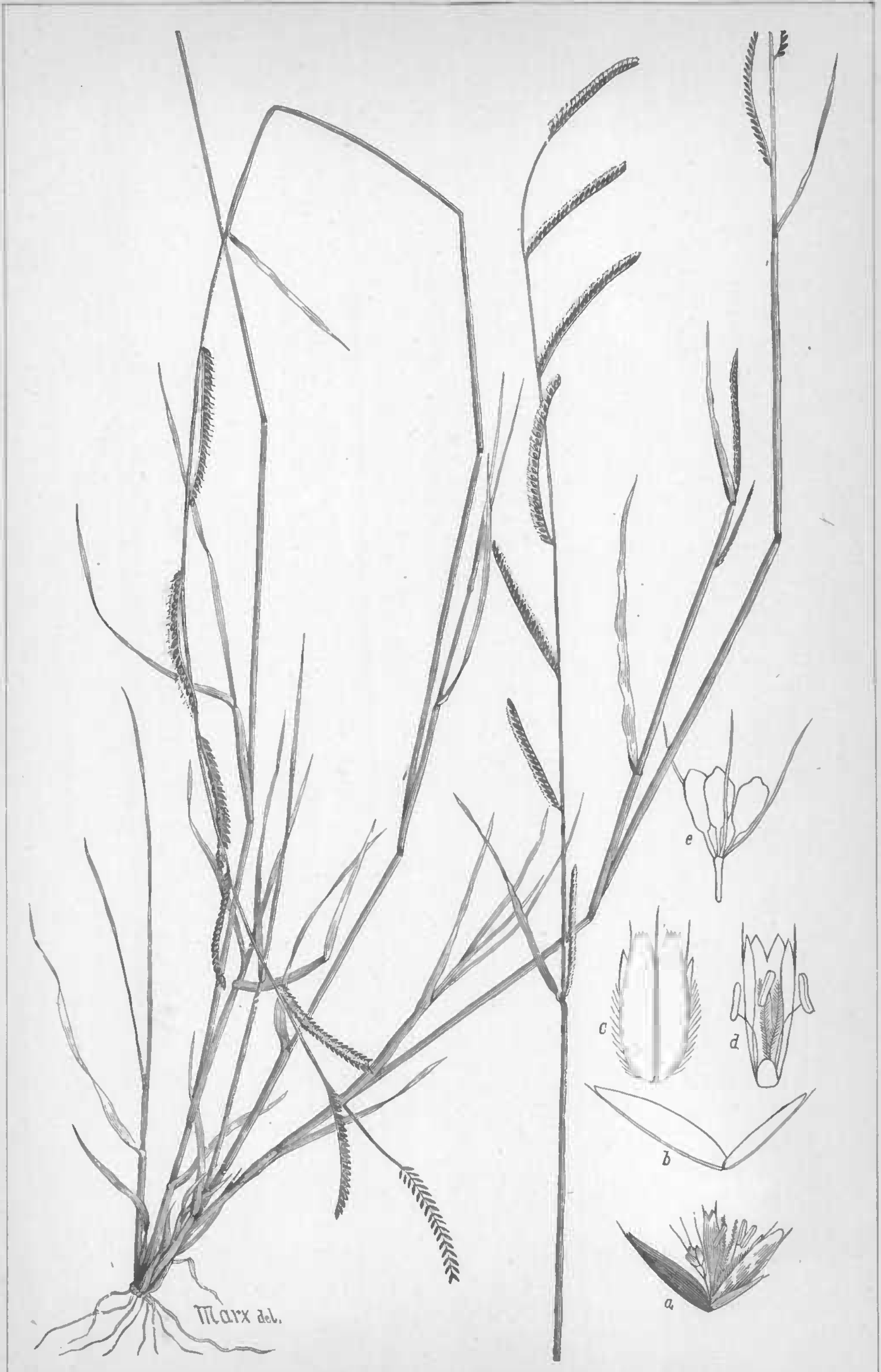
DEYEUXIA HOWELLII.

TRISETUM PALUSTRE.

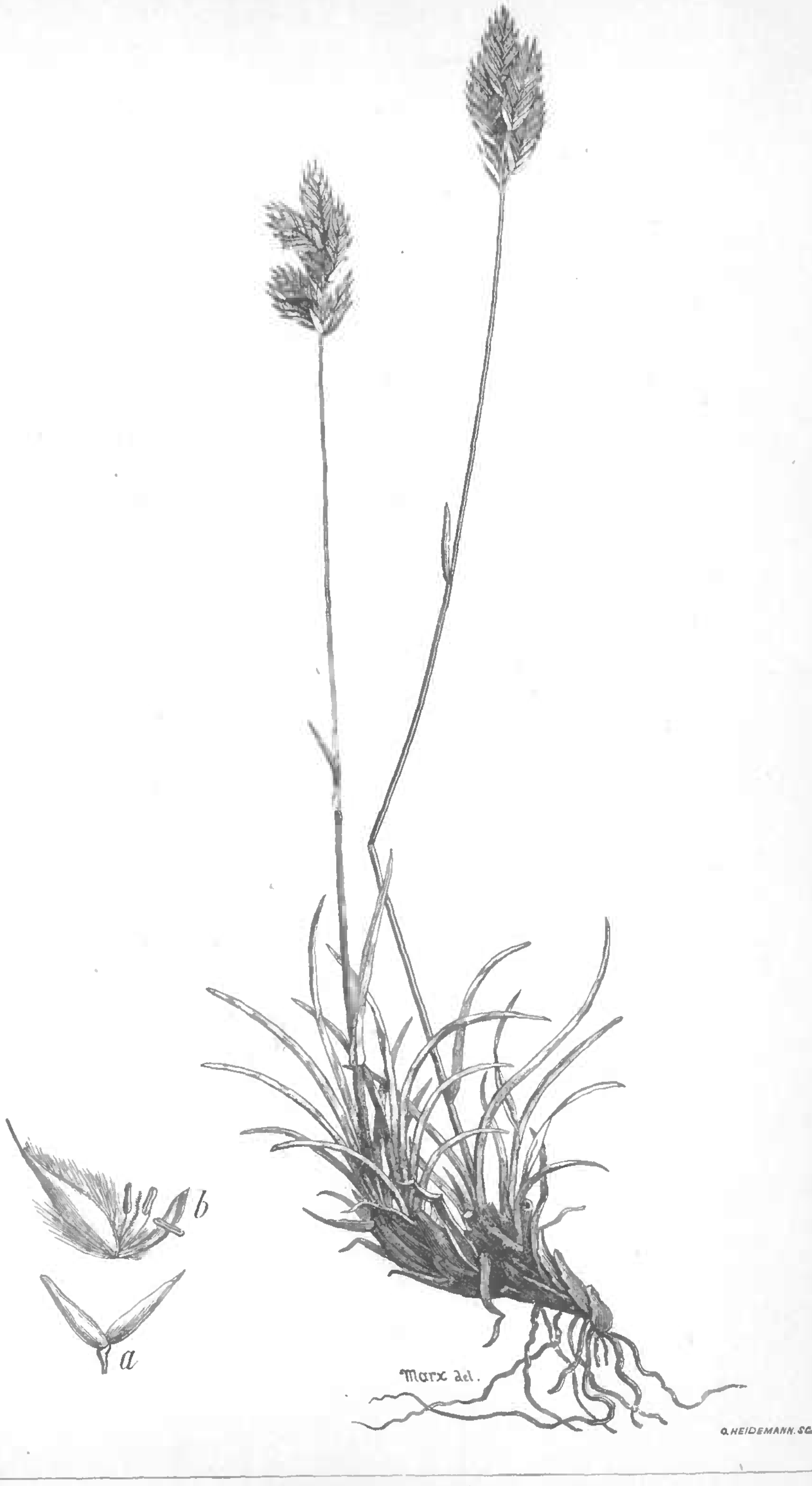
DANTHONIA SERICEA.

SPARTINA JUNCEA.

CHLORIS ALBA.



BOUTELOUA POLYSTACHYA.

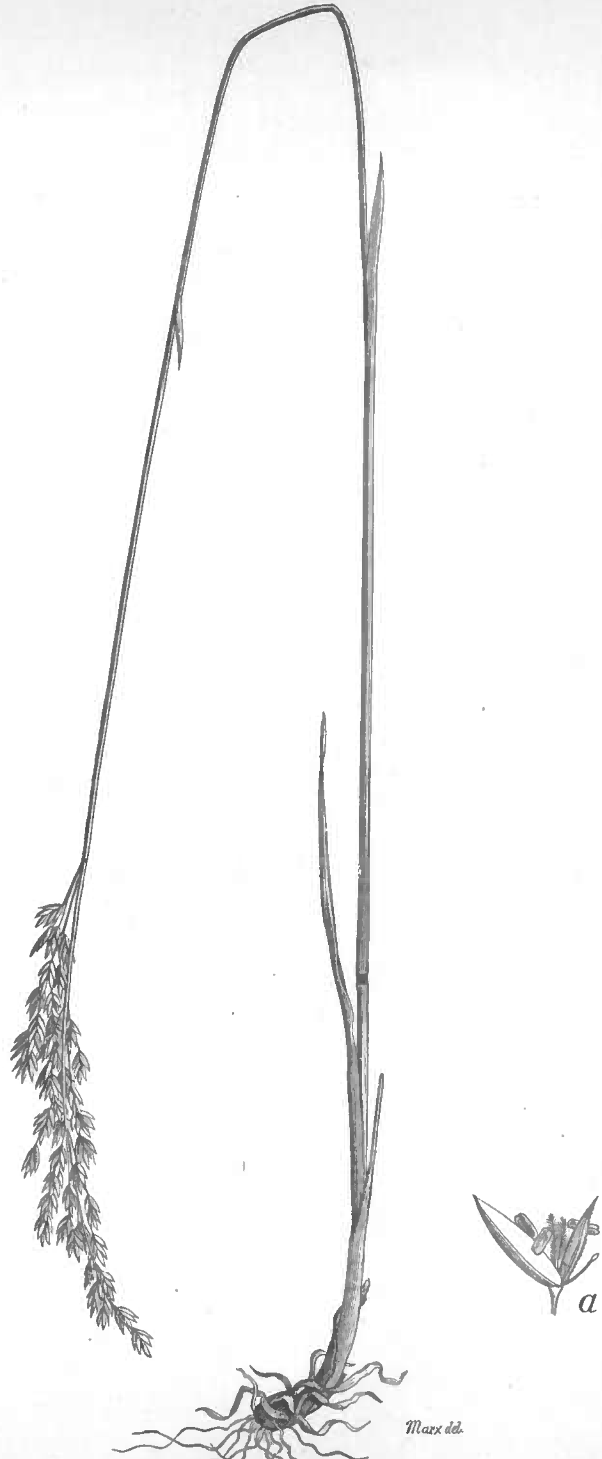


TRIODIA ACUMINATA.

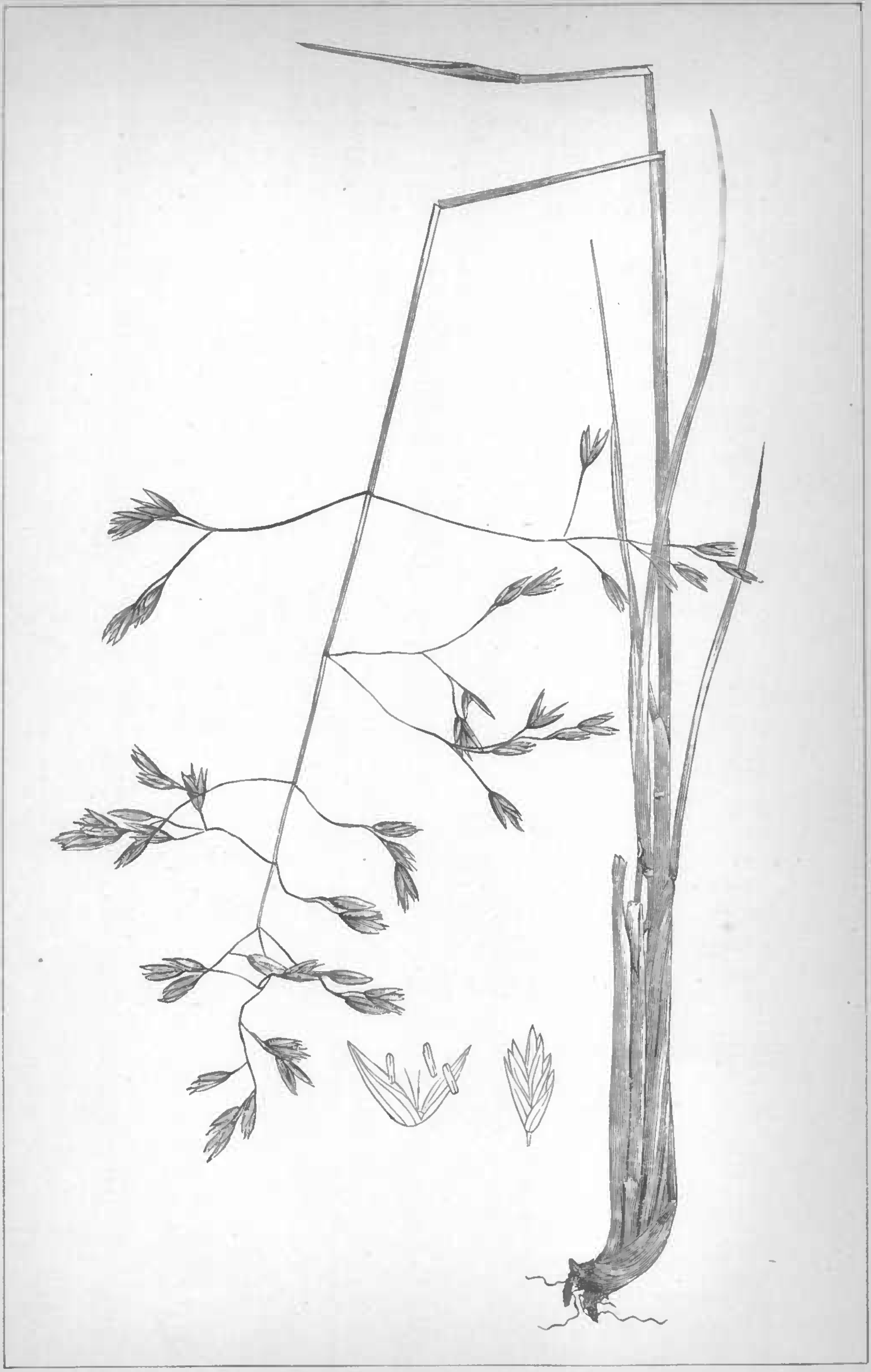
TRIODIA TRINERVIGLUMIS.

DIPLACHNE FASCICULARIS.

DIPLACHNE DUBIA.



Poa andina.



Festuca scabrella.

TRICUSPIS (TRIODIA) TRINERVIGLUMIS.

Another species of the same genus as the preceding, of much larger growth, and prevailing in the same regions. The culms are 2 to 3 feet high, stout; the radical leaves rather rigid, 6 to 12 inches long acuminate pointed, the sheaths more or less hairy. The smooth culm has three or four leaves, which are 4 to 8 inches long and slender-pointed. The panicle is narrow and spike-like, 6 to 9 inches long composed of five or six alternate, sometimes distant, and closely erect branches, the lower ones, 1 to 1½ inches long, and consisting of six to ten sessile, alternate spikelets. The spikelets are eight to ten flowered. The outer glumes are lanceolate, smooth, acute, nearly equal, 4 to 5 lines long, the lower 3 to 5, and the upper, one nerved; the flowering glumes are oblong, three nerved, entire or obscurely denticulate, 3 lines long in the lower flowers, diminishing to 2 lines in the upper ones, acute or obtusish, the nerves and margins densely hairy for about two-thirds the length, also the base and rhachis hairy; the palet is about one-third shorter, two-keeled, minutely-toothed at the apex, hairy on the nerves below. PLATE XXI. *Fig. a, spikelet.*

DIPLACHNE FASCICULARIS.

An annual grass, of vigorous growth, 2 to 3 feet high, in brackish marshes or wettish ground, near the sea-coast, and also far inland in the Mississippi Valley, Texas, New Mexico, and Arizona, in alkaline soil. The radical leaves are narrow and half to two-thirds as long as the culms, scabrous on the margins; those of the culm are similar, with long, smooth, loose sheaths, the upper one usually inclosing the base of the panicle. The culms are frequently branched at the lower joints. The panicle is large, 6 to 10 inches long, consisting of numerous (fifteen to thirty) spike-like branches, which are 2 to 4 inches long, mostly alternate, sometimes fasciculate below, angular and scabrous, and flower-bearing uniformly to the base. The spikelets are nearly sessile and alternate, usually somewhat longer than the space between them; each contains five to seven flowers; the outer glumes are unequal, smooth, one nerved, mucronate pointed, the upper 1½ lines long, the lower one-third to one-half shorter; the flowering glumes are ovate-lanceolate, about 1½ lines long, flattish on the back, three nerved, pubescent on the nerves and margins below, three toothed at the apex, with a short scabrous awn between the teeth, and sometimes two obscure lateral teeth; the palet is slightly shorter, lanceolate, two nerved, and ciliate on the edges. PLATE XXII. *Fig. a, spikelet.*

DIPLACHNE DUBIA.

A grass of similar aspect to the preceding, the leaves somewhat longer and more rigid, the panicle rather shorter and composed of six to ten branches. The outer glumes are lanceolate, nearly equal, acute but not mucronate, one nerved, hispid on the keel, about 1½ lines long; flowering glumes oblong, very obtuse, bifid and ciliate-denticulate at the apex, obscurely three nerved, smooth, awnless; the palet is as long as its glume, narrower, two nerved, ciliate on the margins. The spikelets in age become spreading and the rhachis zigzag.

It is of more southern range than the preceding, occurring in the Gulf States and southwestward. PLATE XXIII. *Fig. a, spikelet; b, single flower.*

POA ANDINA OF NUTTALL.

A perennial tufted grass, with short, narrow, rigid, and pungently pointed leaves, usually involute; the culms are 6 to 18 inches high smooth or nearly so, wiry and naked except about two very short leaves-the blade an inch long or almost wanting. The panicle is 2 to 4 inches long, narrow, erect, and rather loose, the branches mostly in pairs, which are erect, about an inch long, and flowering for the upper two-thirds or nearly throughout. The spikelets are three to five flowered, and nearly sessile; the outer glumes are 1½ lines long, nearly equal, thin, ovate-lanceolate, acute or acutish, the margins scarious, the lower, one nerved and the upper, obscurely three nerved, minutely scabrous; the flowering glumes are oblong, obtuse or obtusish, slightly compressed, rounded on the back, at least below, obscurely nerved, softly and finely pubescent and below villous, the apex scarious and tinged with purple, sometimes denticulate or lacerated; the palets are as long as their glumes, and pubescent on the nerves. The flowers separate very readily and drop off early.

This grass prevails widely throughout the region of the Great Plains and table lands from Arizona to British America. Little is known of its agricultural value. PLATE XXIV. *Fig. a, spikelet.*

FESTUCA SCABRELLA.

A perennial grass, growing in strong clumps or bunches, and hence called "bunch grass." A native of the Rocky Mountain region, from Colorado westward to California and Oregon. The culms are usually 2 to 3 feet high, erect and smooth; the radical leaves are numerous, about half as long as the culm, generally rigid, involute, and scabrous on the margins; the blade is prone to separate when old, leaving an abundance of leafless sheaths at the base; the cauline leaves are about two, short and pointed, 2 to 4 inches long, the sheath scabrous, the ligule short or wanting; the panicle is usually 3 to 5 inches long; the rays spreading, 1 to 3 inches long, distant, usually in pairs below, single above, subdivided to the middle; spikelets 5 to 6 lines long, three to five flowered, the flowers rather distant; outer glumes ovate-lanceolate, membranaceous, acute or acutish, obscurely nerved, the upper one 2 lines long, the lower one-third shorter; flowering glumes lanceolate, acute or short cuspidate, about five nerved, minutely scabrous, of thicker texture than the outer glumes; palet as long as its glume, two nerved, bifid at the apex.

This grass varies greatly in size and appearance in different localities, one form in Oregon and California growing 3 to 5 feet high, with panicle twice as large as the mountain form. Cattle are said to be fond of it, and it is considered one of the most valuable wild grasses of the region where it grows. PLATE XXV. *Fig. a, spikelet.*

GEO. VASEY,
Botanist.

HON. GEO. B. LORING,
Commissioner.

REPORT OF THE ENTOMOLOGIST.

INTRODUCTION.

SIR: I have the honor to present herewith my annual report, embracing some of the work done by the Entomological Division during the fiscal year now closing. The chief article prepared for this report was one on insects injurious to the cabbage, including an account of every species known to affect that plant, with practical suggestions for their control. Within the limit as to the number of pages allotted for the entomological report the original plan has been necessarily modified, and I have confined the matter on cabbage insects to those larvæ of moths and butterflies which are more or less thoroughly amenable to similar remedial measures.

As the Lesser Locust (*Caloptenus atlanis*) has been unusually destructive in the Merrimac Valley, New Hampshire, I have devoted some space to its consideration, and am happy to say that the methods recommended to the farmers of that valley bid fair to give them the mastery over a pest from which they have suffered very seriously for many years. A far more hopeful feeling prevails among them, and by carrying out the recommendations of this report in time another year, I hope that they will never suffer in future as they have in the past.

The subject of protecting fruit and shade trees from the ravages of various leaf-eating insects is one of general interest, and has occupied my attention a good deal during the past two years. As a means of indicating the methods that have been found most useful, I have included an account of the imported Elm-leaf Beetle (*Galeruca xanthomelæna*), with the experience gained in protecting the trees on the Department grounds.

The office force of the Division remains the same as a year ago, and as indicated in my last annual report. The field assistants or special agents in the Southwest are also the same. Dr. A. S. Packard, jr., of Providence, has been engaged in the study of insects injurious to forest trees and in completing the special report on the subject already ordered by Congress. In view of the widespread death of the spruces and larches in the New England States, I requested him to make a special investigation of the cause, and a preliminary report on the subject is embodied herewith. After visiting the dead and dying larches and looking into the matter with Dr. Packard, I am fully convinced of the accuracy of the conclusion arrived at in his report, viz., that the chief and almost only cause of the death of these trees is the work of the principal saw-fly there described, and after careful comparison with Ratzeburg's description, there can be no doubt of the identity of this saw-fly with the *Nematus erichsonii* Hartig, of Europe.

Mr. H. G. Hubbard has also continued work at Crescent City, Fla., on the special report on the insects affecting the orange, and as the question of ridding the orange tree of the scale-insects is a vital one, and experience on the Atlantic and Pacific coasts has so far differed, I have had

Mr. Hubbard pay particular attention to the relative merits of petroleum emulsions and alkaline washes, and have incorporated some recent experience in addition to that given in Bulletin No. 1 of the Division; also some further practical recommendations by Mr. Hubbard.

Mr. Lawrence Bruner is now continuing observations on the Rocky Mountain Locust in the Northwest, and also studying incidentally the insects affecting the chief crops grown in the Rocky Mountain region. He has explored, this summer, portions of the country not previously visited, and already from his reports, and from those received from gentlemen not connected with the Division (especially from Prof. George M. Dawson, who has already been over the British American plains, embracing the northern flanks of the Cypress Hills and the country between the Qu'Appelle River and the 49th parallel in zigzag courses westward to Fort McLeod), it would appear at this writing that the prospect of immunity from the Rocky Mountain Locust in 1884 is as bright for the farmers of the West as it has been at any time since 1878.

As the insects of the South and West have received much of the attention of the Division for the last few years, I have during the past year given some attention to those of New England, without, however, neglecting those of other sections. Mr. J. B. Smith, of Brooklyn, N. Y., is engaged in completing our knowledge of the insects affecting the cranberry and the hop-vine, two crops about which there is much yet to learn from an entomological standpoint. Mr. Smith is also engaged in a monographic work on the Noctuidæ, one of the most destructive families of night-flying moths.

Dr. S. W. Williston, of New Haven, Conn., is engaged in working on two families of Diptera, namely, the Syrphidæ and Tachinidæ, which are particularly interesting to the farmer because of their essentially beneficial character, the one being chiefly predaceous, the other parasitic on plant-feeding insects. Both families comprise many species, and neither have been carefully worked up in this country. In fact, the large majority of species are yet undescribed, and cannot, as a consequence, be definitely referred to by names in reports of this Division.

In the investigations that are being and have been made in reference more particularly to the insects injuriously infesting the cotton plant, the orange, and the sugar-cane, I have often felt the necessity of more accurate information than can be obtained anywhere of the modes of culture and of the insects affecting these crops in Brazil, and especially such species as are known to be common to both countries. Information as to the destructive migratory locusts of that country was also desirable. Mr. John C. Branner and Mr. Albert Koebele were, therefore, commissioned to proceed to Bahia with full instructions to study these various subjects. Mr. Branner had already had much experience in Brazil, and a stay of four months in the country around Bahia and Pernambuco was fruitful of many of the desired facts. A report which he is now preparing will be published later.

The third report of the United States Entomological Commission has been put through the press during the year, and is now ready for the binder, and the fourth report will at once follow.

In accordance with the suggestion in my last annual report, the publishing of special bulletins of the Division has been begun, two having appeared and several others being either ready or in preparation. The special bulletins have, in fact, become a necessity, as the results of the work of the Division can no longer be properly included within the limits allowed in the annual report.

The correspondence of the Division, as in the previous year, has occupied the chief attention of myself and office assistants, though much work on the hitherto unknown life-histories and habits of various species, and experimentation with a view of controlling injurious ones, has been done at Washington.

The illustrations in this report, unless otherwise stated, have been drawn by Mr. George Marx or by Miss Lillie Sullivan, under my supervision.

Respectfully submitted, July 31, 1883.

C. V. RILEY,
Entomologist.

Hon. GEO. B. LORING,
Commissioner of Agriculture.

SILK-WORM NOTES.

The past year has been one of considerable importance in the history of silk culture in this country; not alone in the great extension of the industry, in the founding of new associations and new periodicals, but also in the matter of legislation.

Those interested in the movement watched with anxiety the proceedings of the Tariff Commission, and of the National Congress at its last session. The Tariff Commission, appreciating the force of the arguments in favor of protecting the infant industry, placed a duty of 50 per cent. ad valorem upon raw silk in the schedule prepared for Congress. This duty, however, was dropped by the Senate committee, and the bill as amended in this respect was passed in spite of the efforts of certain Senators, prominent among whom was Senator Morgan, of Alabama, to put at least a duty of 20 per cent. on the raw material. A keen disappointment was felt among silk-growers all over the country at this result, as the success of the amendment would have insured at least the temporary success of the industry, albeit somewhat to the temporary detriment of the manufacturers.

The most important organized effort for the promotion of silk culture which has come into the field since the date of the last report is the establishment of the California State Board of Silk Culture at San Francisco, by authority of the legislature of California. The first regular business meeting of this Board was held on the 1st of June, 1883, when, after the transaction of routine business, it was decided that a short address on some subject pertinent to silk culture should be delivered at every regular meeting of the Board. The first address was delivered by Mr. W. B. Ewer, of the Pacific Rural Press, on the "Progress of Silk Culture in the United States." An appointment was made to have an address delivered at the next meeting of the Board, 6th of July, 1883, by some member of the California Silk Culture Association, on the organization and history of that association, and what it has done to develop silk culture in the United States.

The Board voted to offer premiums to the amount of $150 for the best silk cocoons raised in the State during the year 1883, as follows: Five premiums, respectively, $50, $40, $30, $20, $10; the cocoons to be thoroughly dried and to be put in suitable boxes by the competitors, and to be sent to the State fair in Sacramento in September, 1883, for exhibition.

Bulletin No. 1 was issued by the Board June 1, and gives a list of

members and officers, times of meeting, and objects of the Board. This Board recommends home culture, discouraging speculation; guarantees to purchase all cocoons raised this year in California and to have them reeled at the State reeling school; guarantees to supply the best grade of eggs for next year, and urges every one not to raise any eggs for themselves, lest bad breeds become perpetuated; and gives advice as to the preparation of cocoons for reeling or for the market, and the detection and treatment of diseased worms.

California appears to excel every other State in the attention which it is paying to silk culture, as in addition to the Women's Silk Culture Association of California, and the California Silk Growers' Association, which are mentioned in our last report, we now meet with minutes of the proceedings of the California Silk Culture Association, which is stated to be, although independent of the State Board of Silk Culture, acting in harmony with that Board, and meeting in its rooms. Mrs. Theodore H. Hittell was president of the first-named society and corresponding secretary of the second last year, and is now the corresponding secretary of the last named. We also learn from recent communications from Mrs. Hittell that the State legislature has voted to appropriate $10,000 the coming year to the encouragement of the silk industry.

Reports from persons to whom eggs were sent from this Division in the early part of 1882 continued to come in throughout the new fiscal year. Many complaints were made of the lateness and coldness of the season, but this seems not to have interfered with the success of the experiments except by occasioning the death by starvation of prematurely hatched worms.

Eggs kept from hatching by being exposed to artificial cold in ice-houses and the like yielded healthy worms even after the eggs had become damp and moldy. Miss N. L. Rossiter says she considers artificial cold injurious to the worms, but gives no evidence.

Nearly all the letters (about 1,000) received relating to silk culture were inquiries for information, for the silk manual, for eggs, trees, slips, or seeds. No trees, slips, or seeds were distributed by the Division, such applications being referred to the horticulturist. Nor was any provision made for the general distribution of eggs. The few eggs sent to the Department by various parties as samples, or for other purposes, were made up into small parcels and given away, after retaining such as were required for the use of the Department. The frequent statements in the newspapers that the Government was distributing eggs this year led to a great deal of profitless correspondence and disappointment to applicants. Some correspondents observed that a portion of the eggs which they procured by breeding hatched in the course of a fortnight or less after laying, while the remainder of the eggs did not hatch. Two or three of these correspondents raised a second brood of worms, and speak well of this brood, considering that it takes less time to grow and less care than the first brood. Mr. S. G. Stoney, of Charleston, S. C., raised a third brood, which spun in August, and considered this the best crop of the three.

Correspondents who fed the worms once or twice a day seem to have succeeded as well as those who fed eight times a day; and those who dispensed with stoves as well as those who were particular about the temperature of their rooms.

Mr. Charles Yonson, of Hagerstown, Md., who found his eggs hatching when he received them, and kept them in an ice-house until 22d

May, when they were found to be very damp and moldy, exposed the eggs on that day. On the 29th of May they began hatching. About 20 hatched on the first two days and died. The fifth day's hatch was the largest and most vigorous.

Mad. M. Alden, of Rochester, N. Y., also kept eggs on ice from January to the 25th of May, when she exposed them. One thousand eight hundred and fifty hatched from 2,000 eggs on 8th to 13th June; 1,000 of them on 12th of June. The fourth day's hatch appeared to be the most healthy and hardy of all.

Miss Esther M. A. Marett, of Philadelphia, Pa., tried to feed the newly-hatched worms on parsley and dandelion leaves as well as on lettuce (mulberry and osage orange leaves having been killed by frost). They would not feed on parsley; fed very sparingly on dandelion, but fed well on lettuce for twelve days, and then most of them died. From 350 worms surviving and fed on mulberry, 296 cocoons were obtained, all but one of which proved sound.

Mrs. Cordelia Witherspoon, Wetherford, Tex., states that she fed her young worms on lettuce and elm buds, on which they lived for several days and made healthy worms.

Miss Mary H. Mills, of Alexandria, Va., fed her worms on black mulberry leaves six times a day, hatching them on 7th and 8th June. She was unable to control the temperature of the cocoonery, which ran from 75° to 90° F. Her French annuals, which were very large and fine worms, died by the thousand just as they were going to spin. Mr. E. Fasnach, of Raleigh, N. C., thought she began too late in the season. Some few worms which hatched in the first week of May, and which were kept in a garret and fed on osage orange, made the largest and finest cocoons she ever saw, and very few died.

Mr. William P. Haywood, West Creek, Ocean County, New Jersey, hatched out about 95 per cent. of the eggs sent him, and about that percentage made very fine cocoons. He raised two crops of cocoons; the second crop smaller, but finer in texture, than the first. The worms were fed on cut branches of *Morus nigra*, seldom fed on Sunday, and when the weather was rainy, only fed every other day, but liberally. Worms placed in a mulberry tree outgrew those fed by hand at least 50 per cent., but the birds got them. Mr. Haywood intends to put up a reel this winter, but says it will not pay to raise silk in this country unless the duties on raw silk ($2 per pound) are restored. It cost $2 per pound to reel silk, and as reeled silk from China and Japan now costs from $4 to $6, only $2 to $4 are left for the purchase of cocoons and for profit.

Mrs. Martha B. Bond, of Franklin, Warren County, Ohio, fed her worms on "native mulberry." The temperature of the cocoonery was about 60° F., and the weather wet the most of the time. She had to have a fire in the room all but a few days. She does not think six died of sickness out of the whole lot, after she got mulberry leaves for them, although many died while being fed with lettuce at the outset. A thousand lived to spin cocoons.

Mr. Charles Yónson fed his worms on osage orange from a hedge until about the last age, and then fed osage orange from trees. He mixed a few Morus multicaulis leaves with those of the osage orange. He obtained 971 cocoons, 33 of which were soft. The remainder were 574 yellow (Japanese), weighing 29 ounces, or 317 to the pound, and 364 white (Japanese), weighing 14 ounces, or 416 to the pound. The temperature of the cocoonery was 70° to 80° F., excepting a few days in the last age, when at times it was 65°.

Mr. Joseph J. Smith, of West Philadelphia, Pa., fed his worms entirely

on mulberry leaves, principally the white variety, eight times a day. The eggs were not exposed for hatching until 29th of May, having previously been kept in a cool cellar. They hatched very slowly, and half of them failed to hatch at all. Fifteen per cent. of those that hatched were unable to spin; the rest did very well, but made rather small cocoons. The worms were kept in quantities of about 200, on sheets of newspaper, and transferred to fresh sheets every second day, on fresh leaves. The weather was generally fine and warm; only a few cold, wet days occurring.

J. Herbelin, New Orleans, La., reports having obtained, in thirty-one days from date of hatching, cocoons of first quality, 160 to the pound; 107 pounds from an ounce of eggs; worms fed abundantly on white mulberry only.

On 2d of May, 1883, he reported that he had raised 2,500 pounds of choice cocoons in his three cocooneries, and had imported persons and looms from France for reeling, and was having 15 reeling looms made according to his own invention. Later he sent specimens of his reeled silk, the first specimen being somewhat coarse and brittle, but the last making handsome skeins, and showing rapid and marked progress in the reeling.

James Hyatt, Stanfordville, Dutchess County, New York, reported that "of two packages of silk-worm eggs sent from your bureau to me, one netted $12 to a lady to whom I gave them, and the other furnished 1,200 or 1,300 cocoons not yet marketed."

In addition to the notices of business enterprises contained in the last report, it may be mentioned that Mr. Samuel G. Stoney, of Charleston, S. C., offers to furnish cuttings of the osage orange, Morus multicaulis, and Morus alba, at $1.50 per 100, in any quantity, cuttings to be from 9 to 12 inches long.

Mr. George Gibbs, president, and Prof. G. Barricelli, manager, of the Mississippi Valley Silk Culture Enterprise Company, Holden, Mo., issued, on the 19th January, the first number of a Silk Culture Directory, to be issued "weekly for the silk-raising term." In this they offered to furnish to parties within reach of their headquarters silk-caterpillars already half-grown, to be reared by these parties on half-shares, thus assuming the risk of the proper hatching of the eggs and of the success of the subsequent culture. The Silk Culture Directory contained instructions in the methods of rearing silk-caterpillars, with illustrations and correspondence.

Messrs. W. B. Smith & Co., 27 Bond street, New York, issued, on the 1st of March, the first number of a 32-page quarto monthly magazine, entitled Silk Culture, to be published under the auspices of the New York Silk Exchange, at $1 per annum.

The New York Silk Exchange, 27 Bond street, New York, offered for sale silk-worm eggs, at $4.50 and $5 per 1,000, and mulberry cuttings, seedlings, and trees, at $1.25 and upwards per 100.

Myron Hall, Newton, Kans., offered Russian mulberry trees at low rates.

The Boy's Silk Culture Association of the United States, 703 North Eighth street, Philadelphia, Pa., stated that they were unable to procure sufficient cocoons to fill their orders for reeling, and requested the addresses of parties who had cocoons to sell, offering the highest prices for cocoons.

Mr. Virion des Lauriers, 201 East Sixty-third street, New York, stated that he had market for more cocoons than he could supply. He distributed early in the season the prospectus of a mulberry nursery and

model school farm and cocoonery, to be established at the South Jersey Silk Colony, Bridgeport, Burlington County, New Jersey, on the plan of the school farms and cocooneries of France; but later he reported himself from the Virginia Silk Farm, in Genito, Va., where, on the 10th of June, he was raising the issue of 27 ounces of eggs, expecting to get from them 500 pounds of dry cocoons, besides those set aside for the perpetuation of the breed.

Mr. des Lauriers advertised himself as sole agent in the United States for the French Government silk school farms and nurseries, and as an importer and dealer in silk-worm eggs, mulberry trees and seeds, and silk-culture requisites.

Messrs. Carera, Huber & Co., 176 Bleecker street, New York, offered for sale mulberry trees and silk-worm eggs imported from Lombardy.

Messrs. Hance & Borden, managers of the Rumson Nurseries, Red Bank, N. J., advertised the sale of seeds, cuttings, and trees of silk-food plants, and the sale of eggs and everything required for commencing and carrying on the business.

Notice was sent of the organization in New Orleans of an association styled the Southern Silk Industrial Association, for the sale of silk-worm eggs and mulberry trees. Cocoons obtained by the association from worms fed on white and black mulberry combined were of good quality, moderately large and firm, and the moths seemed free from disease.

Mr. Israel C. Carpenter, of Cherry Creek, Chautauqua County, New York, has invented and put into operation a machine for perforating paper to fit it for the use of sericulturists. He offers this paper for sale preliminarily at the following prices per square yard: 1st age 4 c., 2d age 2 c., 3d age 1½ c., 4th age 1 c.

The quality of this paper is such that five square yards weigh about one pound.

Mrs. Eliza R. Parker, of Bedford, Ky., applied, through Hon. J. G. Carlisle, of the House of Representatives, for assistance to enable her to procure mulberry slips and silk-worm eggs to be cultivated on her estate for the benefit of women of Kentucky and more southern States, She offered to devote her time and attention and to give the use of her house of 40 rooms and her grounds of 50 acres to the promotion of silk culture, by raising trees and eggs "for free distribution in small quantities to ladies desirous of trying silk culture," and by writing instructions in the agricultural papers for the rearing of the worms.

As the Department had no appropriation available for this purpose, it was unable to furnish the desired assistance.

A report entitled "The future of Silk Culture in the United States," by United States Consul Peixotto, of Lyons, France, is published in the Scientific American of 18th March, 1882, and is one of the most lucid and valuable of recent contributions to the discussion of the practicability of sericulture in this country.

Mr. Peixotto considers the principal objection that has been raised to this industry, and answers it as follows:

> The labor and time needed for silk culture in this country can be had as cheaply as in Europe, because it will come from persons who are at present not able, under ordinary circumstances, to obtain remunerative employment. The peasant women of Europe who have no in-door occupation work in the fields. The time they give to silk culture is, therefore, taken from time that would otherwise be used in earning wages or in self-support. As our women do not work in the fields, they have not that resource. In former times they were busied with spinning, weaving, dyeing, cutting, and sewing. Now, comparatively little cutting and sewing is done at home, and none of the other occupations. In hundreds of thousands of homes, where the feeling of

self-respect and the desire to keep the family together are too strong to permit the women to go out in any way to earn money, an opportunity of gaining a very moderate sum in addition to the present income by the expenditure of a few weeks of care and light work at home would be hailed as a godsend. This opportunity would be furnished by the silk-culture industry. It is estimated that with the proper organization of the industry, and the co-operation of neighborhoods in it, an average family may earn from $75 to $200 a year, which would be nearly all clear profit. While the profit is not large it would be sufficient for the occasion, and would amount in the aggregate to an immense accession to the wealth of the community. * * *

Isolated cocooneries cannot be made profitable, on account of the difficulty and expense of sending small lots of cocoons to a distant market. Therefore it is necessary for profit that a large number of families in one vicinity shall engage in the raising of worms, so that their joint product may be of sufficient amount to bear the cost of transportation to market.

The reeling of silk with hand-reels can barely be carried on with profit where highly skilled labor is worth not more than 20 cents for a day of 13 hours. The producers who are not willing to work at that price must, therefore, sell their cocoons to the reelers who can reel at that price, or who can do the reeling by machinery. As good results can only be obtained by the separation of the different grades of cocoons for reeling, large lots must be collected for the purpose, which usually makes it impracticable for the producer to reel her own silk. Silk not well reeled is worth less than the cocoons from which it is derived. * * *

It is to be regretted that some ill-advised persons are still engaged in endeavoring to force silk culture unduly upon the people by exaggerated statements, as for instance those of a Southern lady, who is reported in the Prairie Farmer, of 27th January, 1883, as saying that "silk culture is beyond doubt the most remunerative of any ordinary pursuit," and that the profits from cocooneries "are quite liberal." It is to be feared that by such representations many persons may be induced to devote to silk culture time which could otherwise be better employed, and to incur expenses for which they will receive no adequate return.

Mr. L. S. Crozier, of Corinth, Miss., finds by a trip which he took in Illinois, Iowa, Missouri, and Kansas, that great progress is being made in the introduction of silk culture, especially by the Mennonites, and lays great stress on the importance of the culture of French silk-worms instead of the smaller Japanese varieties.

Amongst the Mennonites he found the mulberry trees planted in thick hedges, at the limits of the fields, and on both sides of the highways and byways. They are cut down, one-third at a time, every three years, and furnish an abundant supply of fuel in the otherwise timberless country, serving also as wind-breaks.

Another point to which Mr. Crozier directs attention is, that although the Mennonites had on hand at the time of his visit more than 20,000 pounds of cocoons for sale, and would be able next year to raise 200,000 pounds within the area of their colony of 50 square miles, containing 2,000 families, yet the silk culture was only a summer incident in their agriculture, and the barns which were used for cocooneries in summer were crowded with cows in the winter, while their granaries were filled with corn and wheat, and their orchards ornamented with all kinds of fruit trees and grape-vines.

Ten varieties of worms were raised at the Department under direction of Mr. Mann, for the sake of experiment and the preservation of the breeds. These were numbered and classified as follows:

Constricted cocoons (Japanese):

White cocoons:

1. Riley's race on mulberry.
2. Riley's race on Osage orange.

Yellow cocoons:

3. Riley's race on Osage orange.
4. Race imported in 1882.

Oval cocoons (salmon-colored):
 Fasnach's Black Thibet:
  5. White worms.
  6. Black worms.
 Crozier's "Black" race:
  7. White worms.
  8. Dark worms.
 9. Crozier's Cevennes race.
 10. Smyrna race.

The buds of Osage orange and mulberry were hardly in sufficiently advanced state for use as food until the 28th of April, at which time all the eggs were laid out for hatching. Many eggs had already hatched, and many worms were dead.

After two days' exposure, all the unhatched eggs were thrown away. The worms were very uneven in their times of molting, occasioning much trouble in their transfer from foul to clean trays, but arrived at the spinning point within a few days of each other. The first to spin was a No. 6, on 28th May. Four, No. 1, and five, No. 10, followed on 31st May; one, No. 2, on 1st June, and all but No. 9 were spinning on 3d June.

CABBAGE WORMS.

The inquires in regard to Cabbage Worms and the best means of treating them have been more numerous, perhaps, of late than in regard to any other class of insects. We had, for this reason, prepared an exhaustive article on the general subject of the insect enemies of the Cabbage, to form part of this annual report; but owing to the restricted space allotted, we are obliged to reserve the larger part thereof, with the prepared illustrations, for some Special Report, and to treat here chiefly of the worms that are amenable to similar remedial measures.

Injury to the Cabbage crop by these worms is great every year, but during no year within our recollection was it greater or so generally serious over the larger part of the country, as during the droughty period of 1881. Indeed, the shortage in the Cabbage crop was such that large quantities of this esculent were actually imported from Europe during the winter of 1881–'82. In default of accurate statistical data it were futile to attempt anything like an accurate estimate of the money loss to our people through the failure of the Cabbage crop, but it must have been very great. This excessive injury was doubtless a result of the dry season, for, during an excessive drought that will burn up most of the wild cruciferous plants upon which the worm in ordinary seasons would be distributed, the cultivated Cabbage, resisting by virtue of its thick and succulent leaves the effects of drought much better than most of the wild plants, offers an inviting field for the concentration of such depredators.

All of these worms feed upon the leaves externally; they are all the larvæ of butterflies or moths—order Lepidoptera—and are all more or less amenable to the same remedial treatment; hence we shall consider the practical question of protecting cabbages from their attacks at the end of this article, making only such special suggestions in connection with some of the species as deviation in habit may require.

The first four which we shall treat are the larvæ of white butterflies

belonging to the genus *Pieris*. They are: *Pieris rapæ*, *Pieris oleracea*, *Pieris protodice*, *Pieris monuste*.

The butterflies agree in most of their characters. The prevailing color of the worms is green, and that of the butterflies white. The hind wings of the butterflies are rounded and entire on the edges, and are grooved on the inner edge to receive the abdomen; the palpi, or feelers, are rather slender, and project beyond the head; and the antennæ have a short, flattened knob. The eggs of all the species are more or less fusiform. They are generally pale when laid, becoming yellow or even orange before hatching. The worms are nearly cylindrical, taper a very little toward each end, and are sparingly clothed with short down, which cannot be seen distinctly without the use of a lens, and which gives them a somewhat velvety appearance. They fasten the anal pro-legs and the anal plate by means of silk, and then spin a loop of silk around the forebody.* Their chrysalides are angular at the sides and pointed at both ends, and over the fore part of the body, corresponding to the thorax of the included butterfly, is a thin projection, having in profile some resemblance to a Roman nose.

The butterflies fly low and lazily, especially when busy in laying their eggs, and successive individuals are often found hovering about for several weeks or months continuously, depositing their eggs where-ever an opportunity presented itself; hence new broods of caterpillars will appear from time to time, and the difficulty of coping with them is correspondingly increased.

In general habit, seasons of appearance, and number of generations, the four agree in the same latitude, and we shall dwell on these points principally in treating of the first, indicating only such differences as are noteworthy when treating of the others.

THE RAPE BUTTERFLY OR IMPORTED CABBAGE WORM.

(*Pieris rapæ* Schrank.)

Order LEPIDOPTERA; family PAPILIONIDÆ.

[Plate I, Figs. 1, 1*a*, 1*b*, 1*c*, 1*d*.]

This insect is a native of Europe, and has become widespread in this country, extending its area of occupation every year.

HISTORY OF ITS SPREAD.

It was introduced into North America, in all probability, about 1856 or 1857.

An interesting account of its first occurrence in this country is given by Mr. G. J. Bowles, in the Canadian Naturalist and Geologist, for August, 1864, v. 4, p. 258.

It was first taken in Quebec in 1859. 'During the time of the Trent difficulty, in 1861, a quantity of fresh vegetables were sent, with other stores from England, to Quebec, for the sustenance of the gallant little army that was sent at the same time, and the butterfly may have been introduced anew and in quantities then, for in 1863 it had become very abundant about Quebec, and was known to have extended some 40 or 50 miles east and west of the city. In the summer of 1866 it was common to the northward about Chicoutimi, at the head of navigation on

* For details as to the method of pupation in these and other butterfly larvæ, see the author's paper in Proc. Am. Assoc. Advanc. Sci., 1879, vol. xxviii.

the Saguenay River, and to the southwestward beyond Montreal. During the same year it was taken in the northern parts of New Hampshire and Vermont. In 1868 it was taken at Montpelier, Vt., Lake Winnipisogee, N. H., and Lewiston, Me.

In 1869 it was taken in Bangor, Me., around Boston, Mass., and on the New Jersey side of the Hudson River, less than a mile from New York City. It seems as if its introduction into New Jersey and vicinity must have been independent of its presence in the North, as it does not appear to have occurred up to that time at all points intermediate. It may have been brought by boats or trains instead of spreading naturally.

In 1871 it was found as far east as Halifax, N. S., and had spread west to the middle of the State of New York.

In 1872 it had traveled as far west in Canada as Belleville and Trenton, Ont.

In 1873 it was abundant at Port Hope, Ont., and the first specimen was taken in Haldimand County, Ontario.

In 1874 it was common about Hamilton, Ont., and what was, probably with error, reputed to be the same species appeared at Green Bay, Mich. (Wis.?), in the fall of the same year.

Early in the summer of 1875 it had extended as far westward as Paris, Ont., while later in the season the first recorded captures were made in London, Ont. (Report Entomological Society of Ontario for 1875, p. 31.) It was plentiful in this year about Washington, D. C., and by no means rare in parts of Virginia, and had traveled westward in the United States as far as the western portion of Ohio. It appeared for the first time at Cleveland, Ohio, in the spring of this year (*Can. Ent.*, 7, 180). Prof. A. J. Cook states that it had not up to that time appeared in Michigan (*Can. Ent.*, 7, 180).

In 1876 it had spread over the whole of southwestern Ontario (Report Entomological Society of Ontario for 1876, p. 40).

In 1877 a few of the advance guard were captured at Chicago, Ill., and it was plentiful as far north as the head of Lake Rosseau, in the Muskoka district of Ontario. It had reached the shore of the Atlantic at the River Saint Lawrence, and was found at Savannah, Ga., probably occupying the whole area embraced between these points.

By 1878 it had reached the eastern part of Iowa, and in March of that year was found in considerable numbers in Asheville, N. C.

In 1879 it was very destructive in Linn County, Iowa, and was taken for the first time at Ames, Story County, in the very center of that State. In that year it was very destructive at Carbondale, Jackson County, near the southern extremity of Illinois. In the same year we found it common in many localities in Alabama, and as far south as Selma, in that State, but it had not yet reached Mobile.

In 1880 Mr. W. Saunders, of London, Ont., found it at Manitoulin Island, near the northeastern shore of Lake Huron; it had extended to various points along the Gulf of Mexico, and had reached far into the West.

RAVAGES.

The history of this insect since its introduction into this country affords sufficient proof that wherever it is introduced it will flourish exceedingly and become far more injurious than either of the indigenous species. Speaking of the habits of this worm, we used the following language in 1869:*

* Second Missouri Report, p. 107.

This Rape Butterfly is the bane of every cabbage-grower, and its larva is the dread of every cook in many parts of Europe. Unlike the two indigenous N. A. species already alluded to, it is not content with riddling the outside leaves, but prefers to secrete itself in the heart, so that every cabbage has to be torn apart and examined before being cooked; and it is also necessary to keep a continual lookout, even after it is dished up, lest one gets such an admixture of animal and vegetable food as is not deemed palatable by the most of men.

Great numbers of worms are often found in a single head of cabbage. The term "*ver du cœur*," or heart worm, has been applied to this larva in this country, the term being borrowed from our French-Canadian neighbors. This term is also in use all over Europe, but the late Professor Zeller wrote us in 1870 that it was misapplied to *P. rapæ*. In Germany, he stated, *Mamestra brassicæ* was the true "ver du cœur," and the *rapæ* never pierced to the heart of the cabbage. Experience in this country would confirm Professor Zeller's statement, though the worm gets to the heart where the head is not too solid.

CHARACTERS.

The eggs are fusiform, yellowish, and longitudinally ribbed. They are so very small that they easily escape observation. When newly laid they are white, but they soon acquire a yellow tinge.

The larva (Pl. 1, Fig. 1*c*) is pale green, finely dotted with black, with a yellowish stripe down the back, and a row of yellow spots along each side in a line with the breathing holes. None of the yellow markings are very clearly defined. When full grown it is about 32^{mm} long.

The chrysalis (Fig. 1*d*), though variable in color, is usually pale green speckled with minute black dots. The butterfly has the body black above, with the wings white. The front wings are black at the tip, and have, in the male (Fig. 1*b*), one black spot between the middle and the posterior edge, but the female (Fig. 1*a*) has two black spots; sometimes three. The hind wings have a black spot on the front margin above, and all the wings are marked underneath very much as those of the female are marked above, except that there is no black spot on the hind wings. The hind wings below are yellowish, sometimes becoming even green. The species varies very much, and there is a specimen in our collection in which the spots are so nearly obsolete above that if it were not for the characteristic under surfaces it could scarcely be distinguished from the Potherb Butterfly. There is also an infrequent variety which has the ground-color canary-yellow, instead of white, and which occurs mostly in the male sex, but occasionally in the female. It has been produced several times by feeding the larvæ on mignonette, but Mr. J. A. Lintner has also obtained it from larvæ fed on cabbage. This variety was first described by Scudder (*Can. Ent.*, *IV*, 79, 1872) as peculiar to this country, and the variety name *novangliæ* was given to it.

HABITS.

When about to transform, the worm usually leaves the plant upon which it fed, and shelters under the coping of some wall or fence, or on anything that may be conveniently at hand, and there changes to a chrysalis, but sometimes it attaches itself to the leaf of the cabbage, and there transforms.

The butterflies are slow and lumbering flyers, but are amongst the most assiduous of insects, continuing on the wing from early morning till late in the afternoon. They are sometimes seen in great swarms, and a case is mentioned of a flight from France to England so numerous that a dark shadow was cast on the decks of channel vessels, and the light of the sun was almost obscured.

The eggs are deposited singly, or in clusters of not more than two or three, on the underside of the leaves.

FOOD-PLANTS.

The principal food of the larvæ is the foliage of cruciferous plants, and particularly the cabbage, but it has been known to feed upon weeping willow in England. Thus far it has been found in this country feeding on the leaves of cabbage, cauliflower, mustard, turnip, radish, mignonette, sweet alyssum, gilly-flower, and nasturtium.

The butterflies feed upon the nectar of a great variety of flowers, but they are particularly fond of hovering about thistles.

A writer in "Land and Water," September 17, 1870, states that the butterflies are very fond of the lavender bush when in blossom; certain bushes in his garden looked white with them, and a single sweep of the net would frequently secure twenty or thirty.

SEASONS OF APPEARANCE.

There are several broods each year, the number varying with the latitude, but owing to the irregularity in the time of development of the different states the eggs are laid at all times throughout the growing season from May until October in the temperate zone, earlier and later in the extreme South, and continue to hatch within from seven to nine days after they are laid, as long as the weather is warm enough to develop them. The larva acquires its full growth in about a fortnight, on an average, after hatching.

The period passed in the chrysalis state varies at different times of the year. In the summer the chrysalis usually become a butterfly within a fortnight; later in the season it remains unchanged through the winter until the following spring.

The butterflies appear as early as March, and at intervals throughout the year, flying until frost, in the Northern United States, and in nearly every month of the year in the Southern States.

NATURAL ENEMIES.

The chrysalides are destroyed by the larva of a minute parasitic fly belonging to the family of *Chalcididæ*, and known as *Pteromalus puparum.* This insect has long been known in Europe as a parasite upon the *Pieris rapæ*, but was not known to occur in this country until some years after the introduction of the latter insect, for which reason it was concluded that the two were probably introduced at the same time. Dr. Packard states, however, that the *Pteromalus* is undoubtedly a native of this country as well as of Europe, having been taken in the Hudson Bay territory in 1844. As there has been some doubt expressed whether our North American insect is specifically the same as the European parasite, we took steps to have the matter fully decided. From examination of specimens recently received from Prof. J. O. Westwood and Dr. G. Mayr, there can be no doubt of the specific identity of the forms from the two hemispheres. Mr. A. G. T. Ritchie, of Montreal, Canada, is reputed to be the first person who made known the history of this invaluable insect in this country, having observed the imagos upon the cabbage leaves in July, 1870, when the caterpillars were abundant, and having bred the parasite on the 23d of August in the same year. This parasite frequently proves an efficacious check

upon the increase of the butterflies. The parent fly differs greatly in the two sexes. The male is a beautiful, pale green, four-winged fly, with the body finely punctured and emitting metallic reflections; the abdomen is flat, and in dried specimens somewhat concave above. The antennæ are honey-yellow, with dark rings. The legs are pale honey-yellow. The length of the body is 2 to 2.5^{mm}.

The body of the female is much stouter, broader, with a broad, oval abdomen, ending in a very short ovipositor, while the underside of the abdomen, near the base, has a large, conical projection. It is of a much duller green than the male, and the body is more coarsely punctate. The antennæ are brown, and the legs brown, becoming pale towards the ends; the ends of the femora being pale, the tibiæ pale brown in the middle, much paler at each end, while the tarsi are whitish, though the tip of the last joint is dark. It is from 2.1 to 2.8^{mm} long.

The scutellum of the metathorax is regularly convex, not keeled, in both sexes, by which character, and by the possession of darker legs, this species may be distinguished from *Pteromalus vanessæ.*

The eggs of the *Pteromalus*, to the number of a dozen or more, sometimes even as many as forty, are said to be laid in the full-grown larva, and sometimes in the chrysalis, through punctures made in the skin by the parent fly. The infested chrysalides can easily be distinguished from sound ones by their livid and otherwise discolored and diseased appearance, and by being stiff and somewhat dried; while unattacked chrysalides preserve a fresh color, and move the hinder part of the abdomen readily. Many of the perfect insects emerge from September until late in the autumn, while a large proportion of them undoubtedly winter over in the body of the chrysalis, and appear in the spring. In England, Mr. Curtis found the fly in June, so that there appears to be an autumn and a spring brood.

Another parasite of the cabbage-worm, not so common as the *Pteromalus*, has of late attracted some attention. It was first bred by Mr. S. H. Scudder, and was described by Dr. Packard as *Microgaster pieridis* in the Proceedings of the Boston Society of Natural History, Vol. XXI (1880), p. 26. In the American Naturalist for August, 1882 (p. 679), in reviewing the paper in which this description appeared, we called attention to the fact, that this so-called new species was but a variety of the common, widespread, and entomophagous *Apanteles congregatus* of Say. As the name *pieridis* proved to be preoccupied by the *M. pieridis* of Boie,* we proposed the variety name *pieridivora*, so that the species will now be known as *Apanteles congregatus*, var. *pieridivora.* In November and December, 1882, we received a number of the cocoons of this parasite from E. W. Allis, Adrian, Mich., and the probabilities are that it will soon become more common.

The European cabbage-worms, *P. brassicæ* and *P. napi*, as well as *P. rapæ*, are much more thoroughly destroyed by parasites than is *P. rapæ* in this country; the former has, indeed, five important parasites. The most prominent of these, perhaps, is the *Microgaster glomeratus L.*, which is also parasitic upon *P. rapæ.* Many years ago it occurred to us that this useful insect might be imported into this country to advantage, and we conducted a correspondence with several foreign entomologists with this view. Later, in some remarks before the London Entomological Society, in 1875, we solicited the assistance of some of our English friends, but the specimens subsequently sent to us never arrived in a living condition. Recently, however, Mr. Otto Lugger, of the

* Incorrectly given in the Naturalist above cited as Bouché.

Maryland Academy of Sciences, Baltimore, who was our assistant in Saint Louis at the time when we were interested in this importation, has had the opportunity of introducing a large number of the *Microgaster glomeratus*. We give his experiment in his own words:

MARYLAND ACADEMY OF SCIENCES,
Baltimore, January 17, 1882.

DEAR SIR: In reply to your letter of Jan. 12, I have to state that, spending some months in my former home, Hagen, Westphalia, I found nearly all the cabbage-plants destroyed by several species of caterpillars, but mainly by the larvæ of *P. rapæ* and *P. brassicæ*. All the stone garden walls, picket-fences, and sides of outhouses were covered with them, but few seemed in a healthy condition. Besides being parasitized by some *Microgaster* (don't know the species*), many were dying from a disease resembling the Muscardine in its fatal effects.

I had no trouble at all to collect, with the assistance of some small urchins, as many of the bright sulphur-yellow cocoons of the parasite as I wanted. In using the expression "sulphur-yellow," I ought to add that a small percentage were lighter in color, some approaching cream-white, and some light olive. Waiting to collect these cocoons until the time of my return trip drew near, two hours' collecting resulted in a little over three pints of cocoons from far less than one acre of garden. The cocoons I kept in three small preserving jars, but with the air-excluding rubber band omitted. During the following three weeks, and until I reached Baltimore, I had no chance to look at them, but found, upon examining the contents of this new kind of preserve, that some of the parasites, say about 10 per cent., had issued and were entangled in the packed cocoons, and mostly dead or disabled. Excepting some 50 cocoons which I kept at home, I scattered the rest in some cabbage fields near this city (October 15 or 16). From those kept, 37 imagos appeared during the late fall and winter—the exact date I did not observe—which I set free. What has become of those scattered in the fields, of course, I do not know; but from the fact that of a handful of cocoons which I put under the protection of a pine tree in a sheltered position, nearly all the cocoons showed the hole of exit, I concluded that those in the fields might also have hatched. Yet, upon close examination in these fields during last summer and autumn, I failed to find a single cocoon of the expected offspring, although larvæ of *P. rapæ* were unusually numerous.

Thinking the matter over, I see plainly that I committed several errors in introducing this parasite. Not expecting such a severe and lasting winter as we had, I ought to have put all the cocoons in sheltered and dry positions out of reach of the excessive cold and moisture, for instance, under pine trees loosely covered with moss, or under protecting boards, &c. The jars should also have been made with a partition, through which the issued insects might crawl and be protected. But the best plan would be to introduce the earlier broods, to give their offspring a chance to find suitable winter quarters for themselves.

The parasitic cocoons were both found upon the dead larvæ of *P. rapæ* and *brassicæ*. Though I tried to gather mainly those upon the first species, I found the work much too slow, the differences between the dead larvæ being not readily observable.

Hoping that this statement may be of some interest to you, I remain,

Yours, very respectfully,

O. LUGGER.

Prof. C. V. RILEY,
Washington, D. C.

Another parasite is the larva of a two-winged fly, belonging to the genus *Tachina*, the adult form of which closely resembles the common house-fly. This *Tachina* was first bred by M. Provancher (*Naturaliste Canadien*, Vol. II, p. 18), as mentioned in our second Missouri report, and has also since been bred in considerable numbers by Mr. J. A. Lintner, at Albany, N. Y. Inasmuch as Dr. Williston will soon work up the Tachinidæ, we defer describing this species for the present.

The butterflies are destroyed also by *Phymata erosa*, a bug especially common in the Northwest, and which also preys upon many other insects. It is shown at Plate X, Fig. 5. (See articles by A. J. Cook, *Can. Ent.* 1879, pp. 17, 196, and by W. S. Barnard, Proc. A. A. A. S., 1880.)

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* *M. glomeratus* L.

THE SOUTHERN CABBAGE BUTTERFLY.

(*Pieris protodice* Boisd.)

Order LEPIDOPTERA; family PAPILIONIDÆ.

[Plate X, Figs. 2, 3, and 4.]

RANGE.

This species, which we have called the Southern Cabbage Butterfly in our second Missouri report, is stated by Mr. S. H. Scudder, in the Proceedings of the Boston Society of Natural History, in 1861, v. 8, p. 180, to range "from Texas on the southwest, Missouri in the west, and the mouth of the Red River of the North on the northwest, as far as Connecticut and the Southern Atlantic States on the east." It occurs rarely in Ontario. While the species is scarce in the more northern and eastern States, it was formerly the common white butterfly of Missouri and the Southwest. *Pieris rapæ* has, however, in the last two or three years, as we some time ago predicted would be the case, taken its place, and become the Cabbage Butterfly of these regions. It will be very interesting to watch the fate of this *Pieris protodice*, and we strongly suspect that it will be influenced by the introduction of *rapæ* very much as some of our native birds have been by the introduction of the English sparrow.

RAVAGES.

It often proves exceedingly injurious, and we have passed through cabbage beds near Saint Louis and been unable to find a perfect head, so riddled were they by this worm, though few of the gardeners had any suspicion that the gay butterflies which flitted so lazily from one plant to another were the real parents of the mischievous worms which did the injury.

CHARACTERS.

The eggs are long, slender, pointed, and deposited singly on the under sides of the leaves, often a score or more upon a single leaf. They are greenish-white in color, and about 1^{mm} in length.

The larva (Plate X, Fig. 4*a*) may be popularly described as a soft worm, of a greenish-blue color, with four longitudinal, yellow stripes, and covered with black dots. When newly hatched it is of a uniform orange color, with a black head; but it becomes dull brown before the first molt, though the longitudinal stripes and black spots are only visible after said molt has taken place.

The chrysalis (Plate X, Fig. 4*b*) averages 16.5^{mm} (0.65 inch) in length, and is as variable in depth of ground-color as the larva. The general color is light bluish-gray, more or less intensely speckled with black, with the ridges and prominences edged with buff or with flesh color, and having larger black dots.

The front wings of the male butterfly (Fig. 2) are white, with a large black trapezoidal spot near the middle of the front edge, a band of black spots crossing the wing between the middle and the posterior edge, and a series of four or five black, triangular spots, each one on a vein along the posterior edge, behind the tip. The upper side of the hind wings is entirely white, or sometimes with a small group of blackish specks near the inner or anal angle. The under side of the front wings

resembles the upper, but the black markings are paler, and the apex is a little greenish. The under side of the hind wings is white, slightly tinted with yellow or greenish, with the veins more pale or ochery; a slight blackish spot near the middle, and a shading of dark specks, scarcely distinct from the ground color, near the edge.

The female (Fig. 3) has the black of the front wings more intense, the hind wings tinted with grayish, the markings being as represented in the figure. The under side is washed with greenish-brown in the veins, and has a band of the same color near the posterior margin. The wings expand 64^{mm}. This species is subject to great variation, especially toward the end of the season, producing every gradation between the form described above and a form which used to be considered distinct, and was named *Pieris vernalis*. This latter expands from 43 to 46^{mm}, and the darker shades are more prominent on both sides of all the wings, especially on the under side of the hind wings, where the white appears only in narrow stripes. This small, darker form is now known to be the vernal form, and not a distinct species, and *P. occidentalis* Reak. and *P. calyce* Edw. are now also recognized as varieties of it.

FOOD-PLANTS.

This species appears to confine its ravages more closely to the Cabbage than any of the other species of the genus, but is occasionally found feeding upon the turnip and other plants of the Cabbage family. We have known it to do great injury to sweet alyssum, commencing at the head and eating down to the base of the plants. We have also found it feeding on mignonette. Moreover, we once found a male chrysalis fastened to a stalk of the common horse-nettle (*Solanum carolinense*), which was growing in a cemetery, with no cabbages within at least a quarter of a mile.

PARASITE.

Edwards states that the larvæ are pierced when very young by a small ichneumon fly, which lays a number of eggs in each individual (Butterflies of N. A., I, p. 35).

THE POTHERB BUTTERFLY.

(*Pieris oleracea* Boisd.)

Order LEPIDOPTERA; family PAPILIONIDÆ.

[Plate X, Fig. 5.]

RANGE.

This species, which is known in the books as the Potherb Butterfly, is indigenous to this country, and occurs in the more northern and eastern portions of North America. It rarely reaches as far south as Pennsylvania, but extends east to Nova Scotia. Couper states that it is not found below the mouth of the Saguenay River along the banks of the Saint Lawrence River, though Scudder claims that this is the species found at Anticosti (*Can. Entom.*, VI, 56–59). It reaches west to Minnesota, though not to Missouri, and north as far as the Great Slave Lake in the Hudson Bay Company's territory, and even, according to Kirby,

to latitude 65° N. on the Mackenzie River. It has existed from time immemoral on the American continent within the geographical limits already given, and is not likely ever to pass to the south of them, although its cruciferous food-plants flourish in the south. It was first described in this country by Dr. T. W. Harris in the *New England Farmer* for 1829, Vol. 7, p. 402, as *Pontia oleracea.*

CHARACTERS.

The egg is pear-shaped, 1.3^{mm} to 1.7^{mm} long and one-third as wide, yellow at first, deepening in hue as it becomes old, ribbed longitudinally with about fifteen sharp-edged lines.

The larva (Plate X, Fig. 5*a*) is pale green, without markings, or of a color resembling the leaves on which it is found. When full-grown it is 38^{mm} long.

The chrysalis varies from pale green to whitish (or soiled white in color), regularly and finely dotted with black.

The imago is readily distinguished from its allies by having no black spots on the wings. The body and head are black, except a few pale hairs which mark the intervals between the segments of the abdomen; the front wings are white, with a slightly blackish shade at their base, front edge, and tips above, and occasionally along one or two of the veins; the tips of the front wings beneath are yellowish; the under side of the hinder wings is straw-colored, except at the angles next to the body, which are deep yellow; the veins on the under side of all the wings are dusky and very well defined, those on the hind wings appearing broad. The antennæ are blackish with narrow white rings, and their knobs are ocher-yellow. The wings expand about 50^{mm}.

HABITS.

While feeding on the Cabbage, the larva is found only on the under side of the leaf, devouring the pulp and leaving the veins untouched. It is stated that leaves which incline vertically are preferred.

The butterfly flutters about during the day, especially in the gardens and over the beds of plants upon which its eggs are to be laid. It is said to be remarkably pugnacious in disposition, and whenever a dozen or more are quenching their thirst around a small puddle, a fierce battle is sure to ensue. The butterflies begin by jostling one another, striking their antennæ together and flapping their wings, then the *melée* commences, and often becomes so deeply interesting that some enemy, a bird or a dragonfly, pounces upon and devours one-half of the struggling combatants before the others have discovered the ill-omened presence.

The eggs are laid three or four together on the under side of the leaves of the food-plant. Mrs. Charlotte Taylor says she has never found the eggs deposited in any place except just where the leaf joins the cabbage-stalk, down in the rim of the midvein.

NUMBER OF BROODS.

There are two broods each year; consequently the butterfly is seen and lays its eggs twice in the season. The first brood of butterflies appears in Massachusetts and Canada about the last of May and in the beginning of June, and in Maine a week or two later; the second brood appears about two months after the first, and remains until September.

FOOD-PLANTS.

The larva feeds on various plants besides Cabbage, such as Broccoli, Cauliflower, Turnip, Radish, and Mustard, but so far as known is confined to the cruciferous family.

NATURAL ENEMIES.

In a popular article in the *American Agriculturist* for 1860, Mrs. Charlotte Taylor describes the manner in which the larva is parasitized by a Microgaster, which she calls without particular description *M. oleracea.* It seems altogether likely that this parasite is identical with the *M. congregatus* var. *pieridivora* to which we have referred in considering the parasites of the imported Cabbage Worm.

THE LARGER CABBAGE BUTTERFLY.

(*Pieris monuste* Linn.)

Order LEPIDOPTERA; family PIERIDÆ.

[Plate X, Fig. 1.]

RANGE.

This species is found in the more southern United States, from Middle Georgia to Florida, and westward to Louisiana. It occurs also in Brazil, Jamaica, Cuba, and Surinam, and probably at all intermediate points. It is larger than any of the others here treated, and in fact is our largest species of the genus.

CHARACTERS.

The eggs are light yellow, subovoid, with the base applied to the leaf; 1.2^{mm} in length and with no visible sculpture.

The larva (Fig. 1*a*), when full grown, is about 40^{mm} in length, lemon-yellow in color, with four longitudinal bands of a purplish shade. Each joint is somewhat spotted with black and covered with sparse and delicate bristles.

The pupa (Fig. 1*b*) is pale-yellowish, marked with blackish, as in our illustration, and characterized by two black filamentous spines on the middle of the body (fourth abdominal joint).

In the male butterfly the upper surface of the front wings is white, with a black border, wider at the apex, serrated within; the upper surface of the hind wings is entirely white. The under surface of the front wings is white, with the border pale brown or yellow ocher, and the under surface of the hind wings is yellow ochery, more or less pale, with the border pale brown, and with a saffron spot at the base.

The female has a bowed black line on the middle of the front wings, and a series of black triangular spots near the edge of the hind wings.

The body is white, the thorax dusky, the shoulders grayish, and the neck ferruginous. The antennæ are black, ringed with white, and with the tip of the club greenish. The wings expand from 50 to 75^{mm}.

In the *American Naturalist* for July, 1881 (p. 577), we published a note

by Dr. Mellichamp on the migrations of this butterfly, which is so interesting that we reproduce it:

I inclose specimens of a white butterfly, thousands of which have been steadily passing over this place from west to east (apparently against the wind) both yesterday and to-day. Savannah (Ga.) is west or southwest of this place, and I am informed that oats had been destroyed there some two or three weeks ago by a caterpillar. Can this stranger be the parent of the same? Being white, they can be seen at a long distance, and they come along in twos, and threes, and fours, and sometimes in a greater number—going steadily east or northeast—seldom stopping ("so hasty" as a darkey would say), but occasionally alighting on a weed, or shrub, or flower (*Gardenia*).

Usually they fly at the distance of fifteen or twenty feet from the earth. Most are white, and larger, I think, than the inclosed; a few are darker, like this other specimen. They are shy and wary and very difficult to capture. A colored man said to me that they came in his field "like a swarm of bees," and that he "just couldn't stand it any longer—never saw such a thing in my life"—and so dropped his hoe and came home.

FOOD-PLANTS.

The larva feeds upon Cabbage, Kale, Lettuce, and Turnip. Morris also gives the Capparidaceous plant *Cleome* (*Gynandropsis*) *pentaphylla* as a food of this species, and Mr. Schwarz has found it in Texas upon *Polanisia trachysperma.*

PARASITES.

A Tachinid fly issued March 2, 1880, from a pupa of *P. monuste* collected at Enterprise, Fla., in February. We simply wish to record the fact, but will not describe the species for the reasons previously mentioned.

A large number of specimens of a Pteromalus closely allied to *Pt. puparum* were also bred from the pupa of *P. monuste* collected at the same time and place. It averages considerably larger in size than *Pt. puparum*, and its general color is more somber. The legs are of a uniform pale honey-yellow.

DESCRIPTIONS OF EARLY STATES.

Egg.—Ovoid, with a truncate base by which it is attached to the leaf. Average dimensions, 1.28^{mm} in length by 0.69^{mm} in width; color light yellow. To the naked eye it appears smooth and somewhat glistening, but shows under the microscope a regular quadrilateral impressed sculpture, the sides of the quadrilaterals being raised. At each end these impressions approach the square, while near the middle their transverse diameter is greater. Near the apex the average measurement of the impressions is 0.036^{mm} by 0.018^{mm}.

Larva—First stage.—Nearly 2^{mm} long when newly hatched, tapering gradually from the prominent head to the anus; color, uniform dirty light-yellow, head spotted minutely with black; four prominent, light brown, chitinous, pointed, piliferous tubercles on each of joints 2–12, each furnished with a long, stiff, dark-brown bristle. *Second stage.*—Color, greenish-yellow, with large polished black head and thoracic legs. The body is very faintly striped longitudinally; two broad, lemon-yellow dorsal bands and one supra-stigmatal band of the same color; the dorsal line and the subdorsal band are slightly grayish; the prothoracic plate is polished black, divided in the middle by the pale dorsal line; the meso- and metathoracic joints have each a row of six large, black, piliferous warts, and each of the abdominal joints a row of four; there are also other very minute black dots; the head is profusely spotted with black dots, from each of which arises a small white hair, whereas the hairs from the piliferous warts on other parts of the body are black. [Intermediate stages not observed.] *Full-grown larva.*—Length, 40^{mm}. Subcylindrical in shape, with a larger head. The general color of the body is lemon-yellow, including the head and prothoracic plate; the front and hind margins of the head are orange; the dorsal line is yellow and the dorsal bands purplish; supra-stigmatal bands yellow and subdorsal purplish. The piliferous tubercles have not altered, except that they appear more strongly marked, particularly those upon the thoracic joints and the two intermediate ones on the anal joint.

THE CABBAGE PLUSIA.

(*Plusia brassicæ* Riley.)

Order LEPIDOPTERA; family NOCTUIDÆ.

[Plate I, Figs. 2, 2*a*, and Plate XI, Fig. 2.]

RANGE.

The larva of *Plusia brassicæ* is the most destructive enemy to Cabbage and other cruciferous plants known to the Southern gardener, and shares that distinction with *Pieris rapæ* as far north as Illinois and New Jersey. It has been received at the Department from Mississippi, Georgia, Florida, Missouri, Illinois, and New Jersey, and we have personally studied it in these States and in the Carolinas, Alabama, Texas, Kansas, Nebraska, Virginia, and Maryland. Curiously enough, a single specimen of what appears without much doubt to be this insect was captured on the south coast of England and figured in the Entomologist's Annual for 1870 under the name of *Plusia ni.* Zeller, however, believed this specimen to have come from America.

FOOD-PLANTS.

The food-plants of the larva of this species are, in addition to Cabbage, Kale, Turnip, Tomato, Mignonette (*Reseda*), Dandelion (*Taraxacum*), Dock (*Rumex*), *Crepis*, *Chenopodium*, Clover, *Senecio scandens.* We have also found it in Florida feeding upon the Japan Quince (*Cydonia japonica*), and it has been found in Washington upon the same plant. Dr. Oemler, of Savannah, informs us that he has found these larvæ the past season feeding upon Tomato and Lettuce near places where Cauliflower and Cabbage had been, and in October last genuine *brassicæ* larvæ, which had been feeding on Celery, were received from M. S. Crane, of Caldwell, N. J. Mr. Crane said: "Some bunches had three or four worms on them, and the stalks of these were nearly stripped of leaves."

During the same months these same larvæ destroyed more or less thoroughly a celery patch at Rives's Station, near Bladensburg, Md. In this latter case the celery patch adjoined a cabbage field, but the circumstances favored the conclusion that the eggs were deposited upon the celery rather than that the worms migrated from the cabbage.

HABITS AND NATURAL HISTORY.

The eggs are pale, greenish-yellow in color, somewhat convex, and about .55^{mm} in diameter (.02 inch). From the center radiate numerous elevated ridges which are divided by transverse and less distinct ridges. They are very loosely attached, either singly or in small clusters, to the leaves, for the most part to the upper, but exceptionally to the lower surface. This fact will explain the apparently conflicting statements upon this point with regard to the related *Plusia gamma* of Europe; Curtis stating that the eggs of this species are laid in groups on the under side of the leaves, while J. Sepp, in his "Natural History of Injurious Insects," represents them as deposited singly.

The larvæ are very soft-bodied and tender, and as they live exposed on the outside of plants and often rest motionless, for hours at a time, they are devoured by birds, are subject to the attacks of at least two parasites, and often die from a fungus disease, especially in wet weather, so that they would not increase so as to be particularly injurious were it not for the prolificacy of the moth and the rapidity with which they undergo their round of transformations.

The young larvæ bore small, irregular holes through the leaves, and where they are sufficiently numerous completely strip the foliage from the head. Growing larger, they work down between the leaves or even bore into the head, although they seem normally to be simply leaf-eaters.

The full-grown larva is shown at Plate I, Fig. 2. It is a looper, and its color is light, vivid green, with lighter longitudinal stripes, which may, however, be entirely wanting.

The length of life in the larval stage varies from two weeks to a month, depending upon climate and weather. In the latitude of Washington there seem to be four broods in an ordinary season, and farther south one or even two more will be found. After attaining its full growth the larva spins a very delicate, semi-transparent web, partially or entirely wrapping itself in a leaf, or even spinning its web bare upon the stalk. The pupa state lasts from twelve to fifteen days. Towards the end of the season the insect in all stages, eggs, larvæ of all sizes, cocoons, and moths, may be found in a badly infested field. Many of the cabbage-heads will have disappeared entirely, and large larvæ will be found gnawing and boring into the tough stalks. When an entire field has been thus stripped, a great migration of partly-grown larvæ takes place. Col. Wright Rives tell us that in 1881 the worms migrated from all parts of a cabbage patch to a field of turnips, some of them traveling a distance of 200 yards. Despairing of saving it, a great part of the latter patch was plowed under.

CLOSELY RELATED TO AN EUROPEAN SPECIES.

This species closely resembles *Plusia ni*, which occurs in Italy, Sicily, France, and the northern parts of America. The late Professor Zeller, of Stettin, Prussia, to whom we sent specimens, considered it distinct, however, from the European *ni*, and the best authorities agree with him. Staudinger would probably characterize *brassicæ* as a "species Darwiniana," and there are doubtless individuals of both the species which approach each other so closely as to be indistinguishable. There is such variation in the silver spot in both that it can not be depended upon alone, but Speyer* has presented other differences that are constant in detail, the most noticeable of which are the darker and more irrorate coloring and the interrupted and wavy terminal line of *brassicæ*, against the paler, smoother, more metallic coloring, and the perfectly straight and unbroken terminal line of *ni*.†

NATURAL ENEMIES.

We have already mentioned the fact that the larva is peculiarly susceptible to the attacks of birds and other insectivorous animals. It is also sought for by predaceous insects. The Carabid beetles, *Cratacanthus*

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* Europäisch-americanische Verwandtschaften: *Stettiner ent. Zeit.*, June, 1875, p. 165.
† See Bull. 6, U. S. Entomological Commission, p. 78.

dubius, *Harpalus caliginosus*, *H. faunus*, *H. pensylvanicus*, and the larvæ of *Collops quadrimaculatus*, *Hippodamia convergens* and *H. parenthesis* have been found in badly infested cabbage fields, with every presumption that they had been feeding on the worms.

The most abundant of the true parasites of the Plusia, in the vicinity of Washington, is a very small chalcid fly of the genus *Copidosoma*. The peculiar habits of this parasite have been described by Mr. Howard in the *American Naturalist*, February, 1882. A larva of the Plusia infested by this parasite is shown at Plate XI, Fig. 3. In the fall of 1880 nearly fifty of the Plusia larvæ were collected with the intention of rearing the moths, but all, with a single exception, were eventually destroyed by this parasite. In other words, only 2 per cent. of the larvæ reached the imago state. As the parasited worms approached full growth, they lost their characteristic, light, longitudinal stripes, and became of a uniform light-green color. Many reached the spinning point before they were destroyed, but others became sluggish, and finally died. It is astonishing in what numbers these little parasites issued from the Plusia larvæ after a pupation of a few days; 2,528 were actually counted, which came from a single parasited worm.

A careful study of the European descriptions indicates that this parasite is identical with the European *Copidosoma truncatellum*,* of Dalman. It is, however, a question which can only be settled by a comparison of specimens. (See Plate XI, Fig. 4.)

We have also bred from the larvæ of this Plusia the ordinary form of the common *Apanteles congregatus* Say, already referred to on p. 112.

We mentioned before that the Plusia larvæ often die of a fungus disease. In the fall of 1882 many larvæ were destroyed in this way around Washington. The affected worms become sluggish, and then die. After death they are stiff and brittle, are attached firmly to the leaves or stems, and are profusely covered with a greenish mold. This fungus was submitted to Prof. W. G. Farlow, of Cambridge, who pronounced it to be a new *Botrytis*. He has sent us his description in advance from the Bulletin of the Torrey Club, and we give it below:

BOTRYTIS RILEYI Farlow.—Mycelium hyaline, diffusely branched, 1.5–2.5 μ in diameter. Spores in whorls, which are approximate at the end of the hyphæ and remote lower down. Whorls formed at the base of elliptical cells attached rather obliquely to the axis, developing into chains of, at first oval, and at length nearly spherical spores 2–3 $\mu \times$ 1.5–2 μ; when young whitish, becoming verdigris green when mature. On larvæ of *Plusia brassicæ*, covering them with a distinctly green powder.

The species is related to *Botrytis bassiana* Bals., which attacks silk-worms, and from which the present species can easily be distinguished by the green-colored spores. The chains of spores, although in general resembling those of *B. bassiana*, are more fully developed than in any form of that species.

REMEDIES.

It will be seen from the experience of others presently to be quoted that the Plusia larva does not so readily succumb to some of the insecticides that have been so successfully used against the other worms.

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* This species is very common in Europe, and is widely distributed. It has been bred by Rogenhofer from *Agrotis fumosa*, *Hadena polydon*, *Leucania albipuncta*, *Plusia concha*, *Pl. deaurata*, *Pl. festucæ*, *Pl. iota*; by Reinhardt, from *Pl. moneta*; by Wallschlegel, from *Catocala electa*; by Brischke, from *Eupithecia absinthiata*. E. A. Fitch (*The Entomologist*, London, April, 1882) mentions that he has bred *C. truncatellum* from closely packed larvæ of *Zeuzera æsculi* and *Thera variata*.

For this reason we shall give here the results of some special experiments which we had Mr. Schwarz make upon this species in the fall of 1881:

October 10, 1881.—Visited Colonel Rives's place, east of Washington, on the District line, and found his cabbage fields utterly devastated by this species, not a single leaf remaining, and the worms feeding on and boring in the leaf stems or in the heart of the plant. They were of all sizes, but mostly full grown. Not many chrysalids were to be seen, and only two or three moths. By far the greater part of the worms were of the striped form, only one of about 25 specimens being pure green.

There was very little chance to experiment with the worms on the cabbage field, and a few infested patches of the turnip field that still remained were selected to carry out the following experiments:

1. One measure of Pyrethrum (1 pill-box full, estimated somewhat less than ½ ounce) was stirred up in 1 gallon of water and applied to the very small plants which were crowded with the worms, by means of a syringe. Even making allowance for the fact that a part of the worms were not touched by the liquid in consequence of the imperfect mode of application, it was plainly to be seen that the solution was not strong enough. Most of the worms showed signs of being affected very soon after application by moving about, and a part of the smaller ones fell in convulsions in due time. Upon examination of the plants treated with the Pyrethrum water about 20 minutes after application it was found that all the older worms were again feeding, and that the larger portion of the smaller ones were evidently recovering, comparatively few specimens still being in a helpless state.

2. Two measures of the powder (about 13 grains), stirred up in 1 gallon of water, was then applied again by means of the syringe in the absence of any better contrivance. Some patches were drenched with the solution, others simply sprinkled. The result was that half an hour later all the smaller worms were still in convulsion, and probably did not recover (judging from my experience with the cotton-worm). The old worms, however, recovered and continued to feed.

The time at my command was too short to carry out further experiments, but I fully believe that three measures of Pyrethrum, stirred up in water, would also kill the old worms; that experiment No. 2, when carried out with a perfect atomizer, would have produced better results; and that this amount of powder is sufficient to kill the younger worms on the plants when applied in a fine spray. I wish to add that in the application of Pyrethrum on cabbage plant the atomizing machine must have a contrivance wherewith to instantaneously stop the flow of the fluid in order to prevent the enormous waste which takes place without such contrivance.

There are about 5,000 cabbages on one acre, and allowing for each head one-quarter gill of the fluid (which is amply sufficient when applied in a fine spray) 40 gallons of the fluid would be necessary for one acre, thus consuming 20 ounces of the powder The actual cost per acre, not counting labor, would be therefore not less than 75 cents (reckoning 1 pound of powder as worth 60 cents). But possibly a larger proportion of the powder would be required, thus rendering the cost per acre at about $1.

In this connection I might add that the smaller quantity of Pyrethrum used, as mentioned above, proved sufficient to disable the flea-beetles (*Orchestris striolata*), and from what I saw I think they did not recover.

October 12, 1881.—At a second visit to Mr. Rives's place to-day no material change in the situation was observed. The application of Pyrethrum water (experiment 2) proved to have killed all the smaller worms of the Plusia, also specimens of *Pieris rapæ* and of *Mamestra chenopodii*, but all the larger worms had recovered and were feeding.

Experiment 3.—One tablespoonful of creosote oil, stirred up in two gallons of water, was applied to a small patch of turnip plants by means of an atomizer. All the worms showed almost immediately signs of being affected, and in about 15 minutes after application the majority of the smaller worms were apparently disabled. Mr. Rives applied yesterday with a syringe the same amount of creosote oil, and the plants were evidently dying to-day; the smaller worms were dead, but the old ones had recovered. It appears that the plant cannot bear a creosote mixture sufficiently strong to kill the older worms.

Early cabbages are planted in May and escaped injury from this and the other cabbage pests; late cabbages are planted in July, and were all destroyed in the vicinity of Bladensburg. There are a few farmers who planted cabbages between May and July, and these made a good crop. In order to get winter cabbage, however, it cannot be planted earlier or later, as in either case the plants cannot resist the frost.

THE CABBAGE MAMESTRA.

(*Mamestra chenopodii* Albin.)

Order LEPIDOPTERA; family NOCTUIDÆ.

[Plate I, Fig. 5, and Plate XII, Fig. 1.]

HABITS AND NATURAL HISTORY.

This species, common all over Europe and in North America, was first noticed as especially injurious in this country in June, 1876, when we received specimens from Mr. M. G. Gant, of Parksville, Mo., with the statement that they were destroying all kinds of garden vegetables, being particularly severe on cabbages. In October, 1881, they appeared upon the farm of Colonel Rives, near Washington, in large numbers, in connection with the larva of the Cabbage Plusia and the Imported Cabbage Worm. The larvæ of the Cabbage Mamestra were at once easily distinguished from the others mentioned in this report by the decidedly pinkish substigmatal line. They varied much in color among themselves (see detailed descriptions at end of article), some appearing quite dark above while others were bright green (Plate I, Fig. 5). It appeared to be their general habit to feed at night, eating the leaves and boring into the heads and stems both of cabbages and of turnips in an adjoining field, and during the day nearly all, especially the larger ones, remained hidden under stones and clods of earth. They also fed extensively upon the common purslane. A later visit to the fields, after the cabbage-heads had been completely destroyed, showed a singular state of affairs. The withered stalks were bored down the center to a depth of several inches, and from this cavity were often picked from twelve to twenty of these larvæ of different sizes, though nearly all full-grown, with occasionally a Plusia larva among them.

There are at least two and probably more broods in the course of a year in this latitude. The Missouri specimens were received June 8, pupated June 12, the first moth issued June 28, and the last moth July 8. The Washington specimens were collected October 11, and were all about full-grown. By October 16 all had entered the ground and soon after changed to pupæ, as was proven by disinterring a specimen in November. In this stage they passed the winter, and the moths issued during the months of March and April.

The pupa (Plate XII, Figs. 1*c*, 1*f*) is found in an oval cavity extending in an oblique direction and about 2 inches below the surface of the ground.

The parent moth is somewhat variable both in size and color, ranging from a pale yellowish-gray to a dark brownish-gray. It is readily distinguishable from the moth of the Plusia to the uneducated eye, by the lack of the silvery spot on the upper side of the fore wings. The wing expanse is about 35^{mm}. (See Plate XII, Figs. 1*d*, 1*e*.)

In Europe it is a very common insect, feeding upon a variety of plants, among which are mentioned by authors: Celery, Lettuce, Cabbage, Asparagus, Spinach, Parsley, Clover, Broom-straw (*Sarothamnus*), Sow-thistle (*Sonchus oleraceus*), Goosefoot (*Chenopodium*), and Vegetable Oyster [*Schwarzwurzel*] (*Scorzonera*). According to Kaltenbach it is in Germany a single-brooded insect, the larvæ feeding during the months of July and August, pupating in September, and issuing as moths the following May and June.

A number of the specimens collected in Maryland bore eggs of a parasitic Tachina fly, and a number of the adult parasites were bred. For reasons previously stated we defer description.

The best remedy, where these cut-worms occur in injurious numbers, will probably be found in the use of poisoned turnip-leaves as a trap. The leaves should be well covered with a London purple or Paris green solution and placed at intervals along the rows. Experiments made upon the larvæ with weak doses of Pyrethrum show that they resist the influence of this agent to a remarkable degree. We append detailed descriptions of the larva and pupa, such not having been previously published, so far as we are aware, in the English language. (See Plate I, Fig. 5, Plate XII, Figs. 2*a*, 2*b*.)

DESCRIPTIVE.

Larva.—Length when fully grown, about 40^{mm}; color, variable; the darker specimens are of a greenish-gray color, the lighter specimens yellowish-green. *Dark form.*—Head yellow, with pale-brownish mottlings, somewhat polished; cervical shield small, subquadrate, somewhat dusky. Body dark greenish-gray or olive green, with numerous small yellowish mottlings; a very narrow yellowish medio-dorsal line and a broader, somewhat interrupted, yellow sub-dorsal line, the inner side of which is bordered on the anterior half of each joint by a very distinct black streak. The substigmatal stripe which runs close below the stigmata is broad and of a rose-color, and is bordered above and below by a narrow yellow line; a small elongated blackish patch surrounds each spiracle. Venter pale greenish-gray, with pale-yellowish mottlings. Anal shield small, and of about the same yellowish color as the head. Stigmata white, with black circumference. Legs pale-yellowish; hooklets of abdominal legs brownish. Specimens which are of a somewhat paler color have the lines and stripes white. *Pale form.*—Head yellow, without any mottlings; cervical shield somewhat lighter yellow than the body. Body greenish-yellow, with few and very indistinct darker markings; no medio-dorsal line; sub-dorsal line so much reduced as to form two rows of 10 separate, elongated spots, which are black above and yellow below; substigmatal stripe of the same color as in the dark specimens. All these light-colored larvæ are infested by parasites.

Pupa.—Length, about 16^{mm}. Color, brownish; thorax and wing-cases somewhat greenish; abdomen somewhat darker, especially the front-margin of joints 4–6. Front of head between the eyes slightly conical. Thorax and abdomen dorsally indistinctly wrinkled; anterior margin of joints 4 to 6, quite coarsely punctured. The remaining joints united, so as to be immovable. Tip blunt, rounded, with four short hooks, placed in a square, of which the more ventral pair is nearest together.

THE ZEBRA CABBAGE WORM.

(*Ceramica picta* Harris.)

Order LEPIDOPTERA; family NOCTUIDÆ.

[Plate I, Figs. 3, 3*a*; Plate XII, Figs. 2*a*, 2*b*.]

In our Second Missouri Entomological Report we gave a short account of this rather striking-looking insect. The present summer it has made its appearance in certain vegetable gardens in Vermont, damaging pease and other crops, and we therefore treat it again under this head of Cabbage Caterpillars, incorporating such new facts as have been ascertained since our former article in 1869.

The young worms are at first almost black, though they soon become pale and green. When full grown (Plate I, Fig. 3; Plate XII, Fig. 2*a*) they measure about two inches in length, and are velvety-black with the head, legs, and belly tawny-red, and with two narrow lateral yellow lines on each side, between which are numerous transverse, white, irregular, zebra-like, finer lines, appearing blue by contrast with the black,

and breaking the latter into lines resembling I V N W. Each lateral line is margined on one side with a narrow white line. The surface of the body is almost entirely free from hairs.

The pupa is three-fourths of an inch in length, deep shiny brown and thickly punctate, except on the posterior border of the joints, and especially on those three immediately below the wing-sheaths, where it is reddish and not polished; it terminates in a blunt point ornamented with two thorns.

The front wings of the moth (Plate XII, Fig. 2*b*; Pl. I, Fig. 3*a*) are of a beautiful, rich, purple-brown, blending with a delicate lighter shade of brown in the middle. The ordinary spots in the middle of the wing, with a third oval spot, more or less distinctly marked behind the round one, are edged and traversed by white lines so as to appear like delicate network; a transverse, zig-zag, white line, like a sprawling W, is also more or less visible near the outer edge, on which edge there is a series of white specks; a few white atoms are also sprinkled in other places on the wing. The hind wings are white, faintly edged with brown on the upper and outer edges. The head and thorax are of the same color as the front wings, and the body has a more grayish cast. The eggs have not yet been observed.

The young worms may be found in dense clusters on their food-plants when young, as they are then gregarious; but as they grow older they disperse, and are not so easily found, although they live exposed on the leaves. The larva invariably curls up, cut-worm fashion, and rolls to the ground when disturbed. It changes to a pupa within a rude cocoon formed just under the surface of the ground by interweaving with silken threads a few grains of sand or a few particles of whatever soil it happens on. In confinement it has been observed to eat with great rapidity and to rest frequently from feeding.

The moths, which are nocturnal in habit, may issue from winter chrysalides as early as May or during June. They probably lay their eggs soon after issuing, as young larvæ are found from the first of June to the first of July; these larvæ change to chrysalides about four weeks after hatching, or from the end of June to the beginning of August (later if raised in confinement), and the second brood of moths, when there is one, appears in the latter part of July, but occasionally the chrysalides of the first brood winter over. The second brood of larvæ, when there is one, appears from the middle of August along into October and hibernates in the pupa state, or it may be in some cases in the larva or moth states.

The spring brood confines itself more particularly to cruciferous plants and young garden vegetables with succulent leaves, and we have known it to be quite injurious; but the fall brood has been found collecting in hundreds on the heads and flower-buds of asters, on the white-berry or snow-berry (*Symphoricarpus racemosus*), on the different kinds of Honeysuckle, on Mignonette, and on Asparagus. Lintner found them in hundreds in a field of cut buckwheat, and also resting on willows and various shrubs bordering the field, in Schoharie, N. Y., on the 19th of September. They are said to occur also on the flowers of clover, and are quite partial to the common lamb's-quarter or goose-foot (*Chenopodium album*).

Dr. Packard states that twice within his recollection they have been extremely destructive to the rutabaga crop in Massachusetts.

On account of their gregarious habit when young, they are very easily destroyed by hand-picking at this stage of their growth.

THE CABBAGE PIONEA.

(*Pionea* [*Orobena*] *rimosalis* Guenée.)

Order LEPIDOPTERA; family PYRALIDÆ.

[Plate I, Fig. 4, 4*a*; Plate XI, Fig. 4*a*, *b*, *c*, *d*.]

PAST HISTORY.

Attention was first called to this insect as a Cabbage pest in the following article, which appeared in the *American Entomologist* for January 1880 (Vol. III, p. 22):

I have something new. It is a new Cabbage Worm, the larva of *Pionea* [*Orobena*] *rimosalis* Guen., which appeared late the past season, remaining on the cabbages till toward the end of November. It is very destructive, doing as much injury to my cabbages after it appeared as the imported Cabbage Worm (*Pieris rapæ*), which has been very destructive here this season. The larva when full grown is six or seven tenths of an inch long (a 16-legged Pyralid larva), slender, slightly flattened; head shining greenish-yellow; dorsal portion of the body down to the breathing pores purplish-brown; this portion marked with numerous transverse whitish lines, two or three to a segment; a narrow, pale-yellow line along the region of the stigma; under side pale green. In the breeding cages they went down to the soil but not into it to pupate, forming a slight, regular-shaped, oval cocoon, thickly covered over with sand.

Miss Middleton's record shows as follows: "Went into the pupa state September 12, 13, and 14; moths appeared 16th to 22d and on to October 1."

After this there was another brood of worms, my description having been taken from living specimens November 21.

The eggs I have not seen, but from the fact that the young feed somewhat together (though not really in companies) I presume a number are laid together. These worms eat, as a general thing, elongate oval holes in the leaves, gradually extending them until nothing but the larger veins remain.

They also bore directly into the heads to the depth of or rather through three or four leaves, a habit, so far as my experience goes, wrongly ascribed to the larva of *P. rapæ*, which will seldom eat through even one leaf of a solid head until it is at least slightly loosened. Lime, ashes, brine, salt, elder decoction, and lye as strong as the cabbage can bear, and other substances tried, have even less effect upon them than on the imported Cabbage Worm. The lye, fresh made of strong ashes, did more good than anything else tried.

I have ascertained that some varieties of the cabbage suffer much less from *P. rapæ* than others, and that bringing them forward two or three weeks earlier than usual so as to have the heads pretty well formed before full brood appears is also an excellent plan to counteract them.—CYRUS THOMAS, Carbondale, Illinois.

[This is the first instance which has come to our knowledge, of *Pionea rimosalis* injuring cabbage. It is interesting as illustrating the unity of habit in the genus which essentially feeds on *Cruciferæ*. The larva *P. forficalis* L., is very destructive to cabbages in Europe, working very much as Professor Thomas has described in the case of *rimosalis*.—ED.]

Professor Thomas, in concluding an article in his Annual Report for 1879, made the following suggestion:

"I think it quite probable that this is a southern species, which like the Rice weevil (*Sitodrepa oryzæ*)* made its appearance in this latitude through the influence of the more than usually long continued warm weather of the past autumn. If I am correct in this opinion, it is not likely that Illinois will ever be seriously troubled with it so long as our seasons remain as they have usually been."

The Department notes would seem to prove that Professor Thomas was right in supposing this a Southern insect. October 10, 1879, specimens of the larvæ were received, with an account of damage to cabbage, from Mr. J. R. Stephens, Lone Star, Itawamba County, Mississippi. August 10, 1880, they were received from Prof. J. E. Willett,

* This is evidently a clerical error for *Sitophilus*.

Macon, Ga., and in September, 1880, from Prof. R. W. Jones, Oxford, Lafayette County, Mississippi, and we have met with it in almost every cabbage field we have examined in Georgia and Alabama.

During October, 1882, it was very destructive in certain localities around Washington. Capt. R. S. Lacey wrote the Department October 2, "I find the Pionea Worm in numbers on my cabbage and perfectly proof against every insecticide of mine. I am, therefore, compelled to use repellants against him as against the Plusia. * * * Next year the Pionea will give us our hands full."

HABITS AND NATURAL HISTORY.

From the specimens and letters received from these correspondents, and from Professor Thomas's article, and our own observations at Selma, Ala., Atlanta, Ga., and around Washington, we have drawn up the following short account of the insect:

The principal peculiarity in its method of work consists in the fact that the worm is not content with simply skeletonizing the leaves, but often bores directly into the head to a greater or less depth, thus working in a much more disastrous manner than the common leaf-eating worms, and rendering remedial applications much less effectual.

The larva is small, active, of a purplish-brown color, transversely banded with two or three white lines on each joint, and is sparsely covered with rather long hairs. It transforms, according to Thomas, within a very delicate silken cocoon covered with a thin layer of sand, upon the surface of the ground. This, however, was in a breeding jar, and he was unable to find the cocoons outside in a state of nature. In our own breeding cages the larvæ transformed to naked pupæ upon the surface of the ground, without a trace of a cocoon. This, however, was probably abnormal. The length of the pupa state in summer is from seven to twelve days. There are probably three or more generations in a season, depending upon the climate, and the insect probably hibernates as a moth.*

PARASITES.

Although Professor Thomas bred no parasites, yet from larvæ which he sent us we secured seven specimens of a small Braconid, and from larvæ received from Mississippi several specimens of the common *Apanteles congregatus* Say, which we have before mentioned.

REMEDIES.

As to remedies, Thomas says:

> The same remedies tried upon the European Cabbage Worm were tried on this species, in fact the two worms worked very harmoniously on the same cabbage; the butterfly larva, as is well known, being of a proverbially quiet and peaceable disposition, avoiding so far as possible encroaching upon the premises of other insects. But this species appears, if possible, still more tenacious of life than the imported worm; it will eat away apparently unconcerned when literally coated over with lime; salt and brine appear to have no effect upon it; strong ashes and weak lye will kill some, especially the younger ones, but to no great extent, unless of sufficient strength to injure the cabbage. Other applications were also tried with little or no better

* In the Entomologist's Monthly Magazine for November, 1882, Mr. William Buckler gives the life history of the allied English species—*Pionea strumentalis*—which also feeds on Cruciferous plants. He shows that the larva molts four times, including the change to pupa, and that it hibernates in the larva state underground in the cocoon, and only changes to pupa the ensuing spring, the moths issuing mainly in July.

effect, but the time allowed for experimenting was not sufficient to exhaust the various means which may be resorted to. I think it probable a flock of chickens would have aided me more than all applications, &c.

The kerosene emulsions treated of under the head of general remedies for cabbage insects will probably prove more successful than any of the others mentioned.

DESCRIPTIVE.

The insect in all of its stages except the egg is represented at Plate XI, Fig. 4. The general color of the moth is rather pale ocher-yellow, the front wings darkening toward the tip, with the hind wings semi-transparent at the base. It is described by Guenée (Deltoides et Pyralites, p. 371). The larva is sufficiently characterized in the preliminary extract, and we will briefly describe the egg and the pupa.

PIONEA RIMOSALIS.—*The eggs* are laid in flattened circular masses, each containing from 20 to 30, and resembling much a mass of Tortricid eggs. They are round or slightly oval, flattened, light-yellow in color, 0.9^{mm} in long diameter, and covered with a faint polygonal sculpture.

Pupa.—Length, 12^{mm} (.47 inch); shape indicated in the figure. Color: wing-cases and head dark brown, abdomen light yellowish-brown. Head small, rounded, with a slight transverse notch anteriorly; wing, antennal and posterior leg-sheaths extending nearly to tip of fifth abdominal joint. Abdominal joints with sutures plainly marked; the two terminal joints closely welded together and forming a conical tip, at the extremity of which are two very minute brown tubercles.

THE CAULIFLOWER BOTIS.

(*Botis repetitalis* Grote.)

Order LEPIDOPTERA; family PYRALIDÆ.

Under the head of Cabbage Worms should be included this species, which was first described as *Botis repetitalis* by Mr. Grote in Comstock's report as entomologist for 1880.*

Larvæ of this insect were originally received from Dr. A. Oemler, of Wilmington Island, at the mouth of the Savannah River, in the fall of 1880. They were reported as injuring Cauliflower quite severely. A single pupa was also received from Dr. Turner, of Saint George, Florida, which had spun up in a leaf of Persimmon. In August, 1881, it was found by Mr. Howard to be very abundant on *Ambrosia artemisiæfolia*, at Savannah, the larvæ webbing the leaves together and destroying many plants.

The moth is not uncommon around Washington, and it is probable that the species occurs in all the intermediate States between Virginia and Florida.

The larva is of a dirty brownish-green color and transforms to pupa in a slight cocoon within a folded leaf. We append careful descriptions of the preparatory states, with the exception of the egg, which has not yet been observed.

The very closely allied *Botis pesticata* Grote, of which this may prove to be but a variety, is a well-known insect in Kansas. In 1873 we found the larvæ feeding upon Helianthus, Ambrosia, Potatoes, and Beets, skeletonizing and ruining the plants for miles along the Neosho Valley and throughout Kansas.

* Annual Report of this Department, 1880.

DESCRIPTIVE.

Larva.—Length, about 20^{mm}, almost cylindrical, somewhat thicker at the middle Color, pale brownish-yellow, with a slightly greenish tinge, and the median line somewhat darker, the whole surface having a glassy and quite transparent appearance. Head light brown, polished; cervical shield polished, its dorsal third almost white, and the sides dark brown; second thoracic segment with a dorsal pair of brown warts, each composed of two smaller ones. All other warts are large, those of the two dorsal rows being transversely oval, the others round; all are polished and of a pale yellowish color. Anal plate of the color of the body. Stigmata pale yellow. Thoracic legs pale brownish yellow. Hairs slender at base, brownish, and towards the end pale yellowish.

Pupa.—Length about 11^{mm}. Head transverse, vertex flat, a transverse depression between the eyes; antennæ inserted above the eyes, with their base very large; eyes with a narrow, polished, backward curve; prothorax slightly excavated; there is a very large pair of transverse stigmata just above base of wing-cases, on front margin of mesothorax; they are polished swellings, with the transverse slit closed by a pale brownish pubescence, and with a deep impression below their external angle. A slight median ridge runs from the head to the third abdominal segment. The whole surface is smooth, almost without any sculpture. Tip of last segment long and quite slender, slightly conical, with shallow longitudinal ridges, and a quite prominent lateral ridge; it is furnished with eight long spines, with twisted tips, two of which are placed at each side, two at tip, and each of remaining two, which are placed on the dorsum, is stationed near the lower lateral spine. The color of the pupa is light brown, with the tip dark brown. It is spun up in a slight white web within a folded leaf.

Adult.—Mr. Grote, in his description of this moth, says: "The abdomen is dotted at the sides of the two basal segments;" but having his type and eight additional specimens before me, I fail to find dots on the two basal segments, except one on each side of the second joint, on all those specimens.

THE CABBAGE PLUTELLA.

(*Plutella cruciferarum** Zell.)

Order LEPIDOPTERA; Family TINEIDÆ.

[Plate I, Figs. 6, *6a;* Plate XI, Figs. *5a–5h.*]

PAST HISTORY.

Inasmuch as this insect has been known to entomologists in this country for the last thirty years, it is strange that its presence has been scarcely noticed by farmers and gardeners, though it has done considerable damage to cabbages from time to time. This silence may, however, partly be due to the small size and agility of the worms, or partly to the circumstance that they somewhat resemble the younger stages of the larvæ of the different species of the white cabbage-butterflies of which we have just treated.

The first account of this insect was given by Dr. Fitch (see his first New York Report, 170, 1855), who observed it in the neighborhood of Ottawa, Ill., in October of 1854, where some of the gardens were so much infested that all the outer leaves of the cabbages were literally riddled with holes and more than half of their substance eaten away. From 1855 until 1870 scarcely anything was heard or written about its ravages, until it was again noticed in the autumn of 1870 by Dr. A. S. Packard, jr., as quite abundant on the leaves of cabbages on the Agricultural College grounds at Amherst, Mass. The same year,

**Synonyms.—Plutella limbipennella* Clem.; *Plutella mollipedella* Clem.; *Cerostoma brassicella* Fitch.

according to Dr. Packard, the same insect did great damage in some parts of Michigan. It was also reported in 1870 to Prof. T. Glover as plentiful and inflicting serious damage to cabbages in parts of Maryland, and the following year its ravages were reported from New York and New Jersey. Since then nothing has been published that we are aware of, but our experience shows that the insect has steadily increased and has spread over nearly the whole section of country east of the Rocky Mountains, being found in all the Atlantic States as far south as Florida, as far north as Michigan, and one specimen was even taken by Mr. V. T. Chambers, near Berthoud's Pass, in Colorado, at an altitude of about 11,000 feet.

HABITS AND NATURAL HISTORY.

This insect may at any time become one of the most troublesome species with which gardeners will have to contend, as it not only feeds upon cabbage, but is equally injurious to the leaves of the different kinds of turnips and other Cruciferæ. Its larva was found by Mr. A. Bolter, Chicago, Ill., feeding upon the leaves of the Wall-flower (*Cheiranthus cheiri*), and also of stock (*Matthiola annua*), from December to February, in greenhouses. Only the expanded outer leaves of the cabbage are injured by this insect, the compact inner head being left untouched, but in those varieties which do not form large and compact heads the cabbage is utterly ruined. The larva is very active, wriggling violently when disturbed, and falling suspended by a silken thread. It is pale-green in color, a little over a quarter of an inch in length (nearly 10^{mm}), and is nearly cylindrical in shape. When ready to pupate it forms for itself a beautiful, delicate, gauze-like cocoon, the meshes of which are so wide that it resembles lace, and through which the inclosed pupa can plainly be seen. (Plate I, Fig. 6*a* and Plate XI, Fig. 5*e*.)

Fitch states that it is destroyed by an Ichneumonid parasite, which, however, he does not attempt to describe. From his description of its cocoon it seems to belong to Microplitis. We have also bred *Limneria annulipes* Cresson from the pupa of this species. It will be unnecessary to give detailed descriptions of the early states, as Fitch has already given them with sufficient minuteness. The winged insect is of an ash-gray color, with an expanse of wings of about 15^{mm}. The male and female are often taken for two distinct species, and there is much individual variation, many of the specimens we have bred being uniformly colored, without trace of the pale costal marks. There are probably two broods a year in the more northern States, and three or more farther south. The insect hibernates in the pupa state. The egg has not been observed.

The following item from the Trans. Linn. Soc., New South Wales, quoted in the *Zoölogischer Anzeiger* July 9, 1883, undoubtedly refers to this species:

> Mr. Macleay exhibited specimens of a small moth (*Tineidæ*), the larva of which was at present creating great havoc in the vegetable gardens in and about Sydney, completely eating up the leaves of cabbages and cauliflowers, and rendering the entire crop utterly useless. The caterpillar, a number of which were exhibited, is an active, slightly hairy, green worm; the pupa is also green, and is fastened to the under side of the leaf on which it has fed by a cocoon of beautiful open lace-work. The rapidity with which this insect seems to reproduce itself is most astounding, and accounts for the short work it makes of a bed of cabbages. The insect was, it is said, first noticed last year, and then not in destructive numbers, so that it will probably be found to be an importation.

REMEDIES FOR CABBAGE WORMS.

From the thousands of nostrums recommended through the agricultural press, we have chosen only those to which we have given personal attention, and can recommend from experience, and also those recommended on high authority and which common sense will approve.

Hot water.—Every worm visible upon the cabbages may be killed by the use of water at the temperature of 130° Fahrenheit or 55° Centigrade. The water may be boiling hot when put in the watering can, but it will not be too hot when it reaches the cabbage leaves. The thick fleshy nature of the leaves enables them to withstand considerable heat with very little injury. The sacrifice of a few heads of cabbage will soon teach an experimenter how far he can go with the hot water. It may be sprinkled over the plants from a fine-rose watering can or poured on with the sprinkler removed. If it is very hot it will color some of the leaves, but even where the cabbage is considerably scorched it will recover and renew growth from the heart.

The attempt is made sometimes to increase the efficacy of the application of water by dissolving in it or mixing with it various substances, such as salt, saltpeter, alum, copperas, and the like, but the use of these is attended with more danger to the plant, and is unnecessary. Other preparations are made by boiling leaves of the elder-berry, smartweed, or other pungent or fetid plants in the water, but the effect of these in killing the worms seems to be no greater than that of the water alone.

Pyrethrum.—Where hot water cannot be applied readily, the most efficacious remedy is the application of cold water with which has been mixed a small quantity of Persian insect powder, or Pyrethrum. Two hundred grains of powder may be mixed with 2 gallons of water, or in the proportion by weight of about 1 to 600, and the mixture sprinkled or squirted on the plants. This powder was first used by us against Cabbage Worms in the summer of 1879, and its efficacy was verified by the independent experiments of several persons made during that and the following years at our request, those of Judge J. F. Bailey, of Marion, Ala., Prof. W. A. Henry, now of the University of Wisconsin, and Prof. A. J. Cook, of the Michigan Agricultural College, being particularly satisfactory.* The results of later experiments at Washington are shown in the reports of Messrs. Lacey and Rives, here appended.

The effect of Pyrethrum powder dusted upon the white butterflies is not very marked, unless the powder is very thoroughly applied, while a very little affects the larvæ powerfully. In the experiments made by Judge Bailey, dry Pyrethrum powder, at the rate of half an ounce to 100 square feet of planted cabbages, entirely destroyed the larvæ or drove them from the plants, and the butterflies ceased to visit the powdered cabbages, and resorted to the turnips and mustard. (*Amer. Entom.*, v. 3, p. 296.)

Kerosene emulsions.—We have advocated strongly for the past three years the use of kerosene emulsified to admit of dilution with water as admitting of very extensive application as an insecticide, and we are satisfied that it will be found of great value in the cabbage field. We omit the details of preparation, but would refer the reader to the last annual report of the Department, pp. 112–116.

Other substances.—Dry applications of lime, salt, pepper, even bran or buckwheat flour, road-dust, soot, or any other powder not deleterious

* See *American Entomologist,* III, pp. 194, 276, and *American Naturalist,* Feb., 1881, p. 145.

in human food, are often tried with some success and recommended against the *young* worms.

Mr. Quinn, writing in the *American Agriculturist* in November, 1870, says that a compound of lime, superphosphate of lime, and carbolic powder (*i. e.*, sawdust impregnated with carbolic acid), was efficient in destroying Cabbage Worms.

A writer in the New York *Tribune*, 6th July, 1872, gives the proportions used as 20 parts of superphosphate of lime, 3 parts of shell or fresh air-slacked lime, and 1 part of carbolic powder. This scattered in small quantites upon each head of cabbage at three or four different times drove the Cabbage Worms from the plants, and the crop was saved, with not more than 5 per cent. of loss.

Either Paris green, London purple, or white hellebore will kill the worms if scattered or sprinkled on the leaves where they will be eaten by the worms, but few persons will use these substances for fear of their poisonous effects.

Cresylic-acid and whale-oil soaps have been highly recommended. Professor Lazenby, of Cornell University, says that a safe, cheap, and effective remedy is to dissolve 1 pound of whale-oil soap in about six gallons of water, and apply it two or three times during the season, or place a few quarts of tar in a barrel of water, and apply the mixture in the same way.

Sprinkling the larvæ with yeast has no effect; salt brine causes the worms to curl up and leave their quarters very suddenly. It does not injure the cabbage in the least, though there are but few plants which will bear such an application.

Preventive measures.—All these remedies, however, are not comparable in excellence with means of prevention, for every application only kills the insects that are on the plant at the time, and as long as the weather continues warm enough to develop them, a succession of new individuals appears upon the plants throughout the season. Experiments with various odors, pungent and repulsive to human sensibilities, emanating from substances placed about the plants, such as musk, camphor, spirits of turpentine, petroleum, asafœtida, &c., were found by Mr. I. B. Taylor (*Rural New Yorker*, November 2, 1872) to be of no avail. The plants must be covered so as to keep the butterflies from them. Fronds of the common brake fern (*Pteris aquilina*) or branches of elder bushes (*Sambucus*) have been used for this purpose, but Mr. Taylor found on spreading a *white net*, with meshes about two-thirds of an inch in diameter, at a height of about a foot above his cabbage plants, and coming down to the ground on all sides, that although the butterflies alighted in great numbers upon the net they never passed through it, and consequently laid no eggs upon the plants. This net, he says, can be so spread as to be removed easily for hoeing the cabbages.

When the worms are found upon a small patch of cabbages, the surest method of destroying them is to hand-pick them and crush them beneath the foot; jarring the plants causes many worms to fall to the ground, where they may be killed.

Poultry, if allowed free range in the cabbage field, will soon clear off the worms of our indigenous species of butterflies or moths, but they are of no avail against the imported Rape Butterfly, as they will not touch the larvæ or imagos. (*Amer. Entom.*, v. 3, p. 55.)

By laying pieces of flat board between the cabbage rows, and supporting them at from two to four inches (50 to 100^{mm}) above the surface of the ground, the *Pieris* worms, as they come to their full growth, will be induced to suspend themselves from the underside to undergo their

transformations, and may then easily be collected and destroyed. This remedy, of course, will only apply to the butterfly pupæ.

The white butterflies being slow and lumbering flyers may easily be caught in a net and killed. A short handle, perhaps four feet long, with a wire hoop and bag-net of muslin or mosquito netting, are the only materials needed to make such a net, the total cost of which need not be more than fifty or seventy-five cents.

The following reports contain the result of certain experiments made at our request during the autumn of 1882, by Capt. R. S. Lacey, the proprietor of a large truck farm six miles west of Washington, and by Col. Wright Rives, also an extensive cabbage grower near the city. They both contain valuable experience:

REPORT OF CAPT. R. S. LACEY.

WASHINGTON, D. C., *October* 31, 1882.

SIR: Professional duties so seriously interfered with the experiments which I have been conducting against cabbage pests during the past four months, under your direction, as to render them incomplete and unsatisfactory. As a consequence I can give you only general conclusions which another year's experience may greatly modify. My very limited experimenting in 1881 led me to place strong reliance upon Pyrethrum as an insecticide, and in the outstart this year I found it to be such against *Pieris rapæ*—the common dark-green cabbage-worm—whether applied in liquid form through your sprayer or mixed with flour and blown on the cabbage with your bellows. But its effect upon the *Plusia*—the light-green span-worm or looper—is in a very minor degree, killing about 10 per cent.; while upon the *Pionea*—the smaller worm with black and yellow longitudinal stripe on its sides—it has no perceptible effect whatever. This latter pest appeared in great numbers upon my late cabbage, and seemed proof against all insecticides, as I could not kill it with Pyrethrum or London purple, no matter how or where applied to it.

I found, as indicated by you, that flour 20 parts and Pyrethrum 1 part was quite as effective as pure Pyrethrum, and given your bellows and only the *Pieris* to deal with, I could easily protect 30,000 cabbage plants during the whole season with 1 pound of Pyrethrum.

My inability to cope with the *Plusia* and *Pionea* led me to reflect upon the statement made by you to me in 1881, that by no possibility could any application put upon the leaves of growing cabbages find its way into the head. Both my manager, a trucker of 40 years' experience, and myself doubted this, but a few days' careful observation this year taught us clearly that the formation of a cabbage head is an unfolding, not infolding process, and that until maturity the outside leaf is continually being thrown off from the head. Under such a state of facts I could not hesitate to use London purple as an insecticide, and though it had little direct effect upon the *Plusia* and none upon the *Pionea*, yet as neither would eat the leaf upon which there was flour containing it, it gave me a repellant which, if frequently applied, served as an absolute check to their ravages. I found common dust finely sifted to be a good vehicle for carrying insecticides, but apparently it is not as desirable as flour, owing to some occasional injury to the leaf on which it is sprinkled. The proportions used were about 100 parts of dust or flour to 1 part of London purple.

I could not teach hired men how to use intelligently any form of bellows, and therefore had all applications made with the fingers. Slinging a small wooden box in front, and then tying it to the body to prevent motion, left both hands at liberty; one to slightly uplift the uprising leaf, the other to sprinkle the dust underneath it, but to my vexation I realized that the *Pieris* always anticipated my laborers' intelligence as to the movement of this particular leaf, and was snugly esconced thereunder, with perhaps half a dozen comrades, before his single perforation was discovered.

An observing, active man who has studied carefully the habits of the worms and the peculiarity of the cabbage growth, need experience little difficulty in either killing or checking the pests with flour or road-dust containing either Pyrethrum or London purple. Light applications frequently made are better than heavy ones at long intervals. Once the then outside leaf loosens from the head it serves no more to protect the head from attack than if bodily removed. I read of others who save their cabbages by one or two applications of some certain wash or powder. But the rascals ravaging my cabbage plants were not such easily demoralized soldiers as that; for, finding they could not attack the head under freshly applied repellants, they laid siege, ate up all the loosened leaves, and swarmed down in hordes on every exposed and unprotected surface. Another year I will combine solid and liquid applications, preparing the whole head, including the loosened leaves, by thorough washings, for

freshened sprinkling with flour or dust. The sprayer furnished by you—the one devised by your assistant, Dr. Barnard—is certainly an admirable instrument, the nearest perfect of any I have seen (see Plate V). With it for use of liquids, and with fingers intelligently directed in applying flour, &c., I see no reason why I cannot easily and economically protect 30,000 cabbage plants. This year's experience on 10,000 late cabbage plants certainly so indicates.

I used no Paris green. The fact that it is indissolvable may enable it by some blow or accident to get into the head; London purple, however, no matter where put, will not remain under the washings of dews and rains for the period of a week. It is a delicate matter of course to urge upon others the use of any poisonous applications, but I am so thoroughly convinced of the absence of danger involved by mixing London purple with flour or dust in the proportions specified herein, that I feel free to speak of my practice with it.

I joined you in 1880 in condemnation of both it and Paris green, but a clearer understanding of the manner of growth of the cabbage plant has removed my objection to it, though not, as before stated, to Paris green. I netted and killed over 5,000 butterflies, the parent of the *Pieris*, but without apparently diminishing the numbers. As a consequence I shall next year grow only late cabbages, and concentrate my efforts on them; the early causing an unprofitable prolongation of the warfare. I never was able to detect the parent of the *Plusia* or *Pionea* in my plats, and obtained them only by hatching the pupæ in bottles in my room.

Another season I shall carry out your suggestions as to catching these moths with poisoned sweetened water, and shall not by any means abandon netting the butterflies.

In conclusion, killing cabbage pests simply means persistent and continuous effort, and he who fancies that such enemies, which are on the alert from the time the seed is sown until frost checks them, can be subdued with one or a dozen sweeping massacres, whether with net, poisons, or careful hand-pickings, will certainly come to grief in dry, warm weather.

Permit me to return my thanks to you for your kindness and most valuable suggestions. Through them I believe I can successfully grow cabbage on a large scale in so far as the pests described herein are concerned, and given an insecticide which will kill the *Plusia* and *Pionea* as summarily as Pyrethrum dispatches the *Pieris*, I am confident that the trucker can prevent their ravages as effectually as those of the Colorado beetle with Paris green, the only difference being that in the latter case the poison kills both beetle and larvæ, while with the cabbage pests the insecticide must necessarily be directed chiefly against the larvæ, thus leaving the cause to operate against us.

Very respectfully, your obedient servant,

R. S. LACEY.

Prof. C. V. RILEY,
United States Entomologist.

REPORT OF COL. WRIGHT RIVES.

WASHINGTON CITY, *March* 26, 1881.

SIR: In compliance with your written request, and the interest you take in the matter, I herewith submit my experience with the cabbage-worm and the remedies I have applied either for its destruction or prevention. Previous to the fall of 1880, in this vicinity, near Washington City, in Prince George's County, Maryland, we had, as I may say, no worms that did any injury to the cabbage, although I had noticed the white butterfly. In July, 1880, I planted about 20,000 cabbage plants in ground well prepared and enriched, and the plants made rapid growth from the time of planting. In the latter part of August or first part of September I noticed my cabbages covered with numerous green worms, and upon reading up the subject I found them to be the cabbage-worm. I also read at the same time the remedies for their destruction. I first made an application of salt and of lime, both separately and combined, but it had not the slightest effect. I then applied ashes with the same result, as also red pepper and Scotch snuff, combined and separately, as also carbolate of lime, which Mr. I. I. H. Gregory, of Marblehead, Mass., in his work upon cabbage, said was a certain preventive which was used in Europe, but all of them were useless. I then commenced with hot water, but as it was such a big job I immediately abandoned it, and did not notice the result, as, if a remedy, it would be too expensive upon a large scale. Seeing that unless something was done immediately, I would not save a single cabbage, I went to the Agricultural Department, consulted the entomologist, Professor Comstock, who promised to come out the next day and make a series of experiments. He came at the appointed time and brought some Pyrethrum, which he mixed with flour in the following proportions, to find out the smallest quantity that would be of service, viz., 1 Pyrethrum to 6, 10, 16, and 24 of flour, and also 1 ounce to 1, 2, and 3 gallons of water. The experiments were made upon separate rows and each staked with labels of what was applied. To sum up briefly, we found, 1 Py-

rethrum to 6 of flour killed the worms in less than one hour, as did also the strong solution, and that in those of 24 flour all were dead in less than twelve hours. I immediately purchased in a drug store in Washington City the next day a quantity of Pyrethrum and applied it at the rate of 1 to 16, and killed all the worms except those that had eaten into the heart of the cabbage. About the middle of November I put my cabbages away by taking them up and giving a good shaking to expel as many worms as possible; laid them in rows, with heads inclined to 45°, and covered them with pine bush. The winter of 1880 and 1881 was the coldest ever experienced here, the thermometer once having gone to 17° below zero, and at least a dozen times to 10° below zero; yet, notwithstanding this intense cold, in the spring of the year, when the cabbages were removed, I found a large number of worms in full vigor, and in no instance could I discover where the cold had killed any. Professor Comstock made full notes of these experiments and their results. This spring I concluded to plant about 10,000 cabbages, as this was all the available ground I had for the purpose, and with the results from Pyrethrum I believed that I should save every head, or rather prevent any worms destroying any. Accordingly I thoroughly prepared the ground upon a portion, applying bone dust at the rate of 1½ tons per acre, and on the remainder Peruvian guano (Lobos) at the rate of 1,000 pounds per acre. The cabbages were planted about the 15th of July, and made rapid growth, but in September, I noticed numerous worms. I immediately applied the Pyrethrum, having purchased it of a druggist of Washington, but it did not kill a single insect, as I could discover, so I concluded that it must have been adulterated or old, notwithstanding it had a good color and had a strong smell. I then purchased a quantity of another druggist of Washington, who has the reputation of keeping the purest drugs, but this was of no avail, although I applied it at the rate of 1 to 10, and also pure. Here was a result entirely unexpected, as I believed that what would kill them once would kill them again, but in this case all past results were useless. As I had been using carbolic soap for a number of years as a wash for my dogs, to free them from fleas, and thought perhaps as this killed the fleas instantaneously that it might kill the cabbage-worms, I made several solutions of various strengths (the strongest being ¼ pound of soap to 1 gallon of water), but this had no effect. I then applied solutions of whale-oil soap, with the same effect. I then came to you and told you of the above results, and you promised me your assistance, and in two days afterwards sent out two of your assistants to make experiments. They brought with them Pyrethrum, sold as Buhach, which was guaranteed to kill all insect life or to forfeit $100 in case of failure. It was applied with flour in the same proportions as in the previous years, also in solutions, and in a pure state. The result was that it killed some of the smallest worms, and made the others wriggle a good deal, but in a few hours afterwards they seemed as well as ever. This result seemed to astonish your assistants, as they firmly believed that one-half ounce of Pyrethrum to 1 gallon of water would be instantaneous death, but when the pure powder put on with a bellows had such an insignificant effect, they concluded that if put on in a fine spray instead of by a watering-pot or large syringe it would prove more effectual. In two days afterwards they came up again and brought a pump to throw a fine spray, also some wood oil; the Pyrethrum and wood oil were applied in a spray form in various strengths, but with no success whatever. I also applied creosote in various strengths, as also coal oil, quassia, nitrate of soda, turpentine, peppermint and several similar substances, but in not one single instance did any have the slightest effect; so at the latter part of October I retired from the contest for this year completely defeated, and out of 10,000 cabbages I had not enough leaves to make a nest for a humming-bird. I should say that when the Pyrethrum did not work I had the cabbage hand-picked three times, and every worm seen killed, but in a short time there were just as many. Your assistants discovered that the insects (worms) on my cabbage were from the native butterfly, and in a cabbage patch on an adjoining farm not four hundred yards distant, the worms they found were produced by the eggs of the foreign butterfly; but I need not state these facts as their report to you no doubt contained a full account of them, as also of the parasites found, and the variety. Adjacent to my cabbage I had an acre of turnips, and next to these half an acre in kale. The cabbage worms remained on the cabbage until about the latter part of October, when one night we had a severe frost and the thermometer went to 30°; the next day was clear and warm, and about 10½ o'clock, in going to the cabbage field, I noticed when near it that the ground seemed perfectly green as if covered with a heavy turf of grass, and upon reaching it I discovered that every worm had left the cabbage, and was moving toward the turnips at a rate that carried them over the ground at about 100 feet an hour. As far as they had entered the turnips they had completely cleared the ground. In order to save my kale I had the whole turnip field and a portion of the cabbage plowed and buried them so deep as to kill them.

It is hard to account for this opposite action of Pyrethrum, but in order to solve the problem it may be of service for me to say that last year the worms appeared earlier than this season, and when the Pyrethrum was applied it was to the first brood, and,

as intense cold commenced very early, there were no late broods, while this year, on account of the drought, we have had two broods, and perhaps three, and maybe the second brood is more tenacious of life than the first brood. Before I conclude let me say that last year, in the way of experiment, I applied Paris green and London purple upon a few broods and that it killed every worm, but neither of these preparations will do, as both are deadly poison, and if used would either prove fatal or very dangerous to human life. I regret to say, however, that one paper in this city had an article recommending Paris green to be used to destroy the worms, and I regret to say that I have heard of some farmers who, no doubt, being ignorant of its arsenical properties, have used it. This year my celery, and that of a number of others, was infected with the cabbage-worm, and was only saved by constant picking, so that you see that unless some remedy is found the celery crop is endangered. I should say that last year and this year I made an application of lime and salt, separately and combined, also in strong solution, but was of no avail. Since you have been so successful with your remedies for the destruction of the cotton-worm, I earnestly hope that next year you will have the Government take up the subject of the cabbage-worm, as it is one that not only affects nearly every portion of this country, but is, I may say, the standard and almost daily dish of the laboring man, the bone and sinew of the country, who, in the hour of its peril, shouldered the musket and saved the Union. Surely in recompense for this Congress will, if their attention is called, vote an ample appropriation to find some means not only to help the laborers but to assist the farmers upon whose prosperity rests that of the country.

Let me say that in my immediate vicinity there are many farmers who plant from 5,000 to 20,000 fall cabbage annually, and they planted their usual quantity this year, and yet not one of them has to-day a single head of cabbage. In the northern portion of this county I have talked with farmers who made this crop a specialty; one planted 26,000, another 50,000, another 75,000, another 150,000, and another 160,000, and not one of them has to-day a single head; all their labor and fertilizers have been of no avail, and instead of an income there has been a total loss. I will next year plant some in order to experiment upon and see if I cannot hit upon some cheap remedy, for unless it is cheap it will be useless. If you desire to experiment for the Government I will furnish you with plants and ground free of charge and do all I can to assist you to solve the problem. You have no doubt seen notices in the papers of the arrival of cabbages by the various steamers from Europe, and this tells the story far better than I can of the ravages of the worm—when merchants can buy cabbage in Europe, pay the bulky freight upon fast steamers for 3,000 miles, and then sell them in this country. In conclusion let me say that I am ready at all times to furnish you data upon the contents of this communication. Since writing the above I have read your long letter to me in regard to the destruction of the worms and have found that some of the remedies you recommend I applied but forgot to mention them. I need only to say that none of them were of service, viz: saltpeter, cresylic soap, copperas, hellebore, superphosphate of lime.

With respect, your obedient servant,

WRIGHT RIVES.

Prof. C. V. RILEY,
Entomologist, Agricultural Department.

POISONING DEVICES.

The need of some simple devices for the application of the various substances, both dry and liquid, that are to be used against Cabbage Worms was obvious, and, after considering such as were already known, it became evident that something better could be devised for powdering or spraying by hand low-growing plants of various kinds.

Those here described and figured (Plates IV, V) were planned and perfected with the assistance of Dr. Barnard, who was charged with their construction, and who worked out the details according as experience and experiment suggested.

Fig. 1 represents a small bellows, *v*, with handles, *hh*, one of these serving as a discharge spout, communicating at *e*, through the powder receptacle, *p*, to its delivery at *s*. The bellows is made mechanically tight without glue or other adhesive, soluble on exposure to wetness, and possesses great power. Taking the discharge from the handle of the bellows renders it of simpler construction and enables the hand supporting the powder can and extension pipe to be close to the can, while the body of the bellows tends to balance the weight of the powder, &c., making

the tool more easily wielded than if the weight were more distant from the hand. The form of the can is found to be preferably that of a double cone or double pyramid. At its top is a can-screw opening for inserting the powder and closing it securely from wetness. The blast spout passes radially against the inside of the basal cone. The internal relations of the blast to the powder will be better explained by observing Fig. 2, which is a sectional view longitudinally through the parts. The tube, *e r*, inside the can, has a slot in its side, or sides, and about midway in its passage is a shut-off device, *j*, where this is set, partially closing the tubular passage; only a part of the blast going through direct, while the rest is crowded out to grind away the powder exposed by the slot passage. The more of the blast thus crowded out, the more of the powder will be fed to, and carried away by, the blast. One, two, or more slots or rows of holes of size and shape to suit may be thus made whereby the blast can act upon the powder in the base of the can.

Other views of the same device, with an extension pipe, having a crooked discharge end, appear in Figs. 4 and 5. The lettering has the foregoing explanation so far as it corresponds; but *j* indicates the upper or movable face of the bellows, *z* a gauze cover over its incurrent valve, *i* is the long extension pipe, with a crook, and *s* its discharge. The long pipe enables the poison to be freed at a safe distance from the operator, and the crook allows it to be easily applied either in an upward or a horizontal direction into the plant.

Other crooks desirable for some purposes are shown in the extension pipe as seen in Fig. 3. These blowers work with little effort and do very satisfactory work.

A tool very similar in shape, but for blowing liquid spray, is represented in Figs. 6 and 7. The bellows is the same as that explained above. The blast pipe, *h*, *t*, *r*, *i*, *s*, is connected with a separate part of the reservoir, *p*, for the poisoned liquid, and a can screw-cap, *y*, is found convenient for this purpose. When the receptacle is removed by unscrewing it, the small feed-tube, *x y*, and the blast-pressure orifices, by which the blast-pressure in the tube is communicated into the reservoir and upon the liquid therein, except that which is in the feed-tube and to be ejected by said pressure, to squirt liquid through the feed-pipe into the blast-pipe, are exposed to be of easy access in case of choking of the passages, or if it is desired to readjust their alterable capacity to feed a greater or less quantity of liquid to the blast. The peculiar form of the poison-can, *p*, with the feed-tube terminating in its basal apex permits a greater range of tilting of the same without interfering with the supply to the feed-tube, even if the liquid is low. But the construction is such that the apparatus feeds when inverted or when in any other position, and in all positions the feeding is by virtue of the blast-pressure, through an inlet from one part of the blast-pipe where the pressure is greatest to the interior of the receptacle and upon the liquid therein, to eject it into another part of the blast-pipe where the pressure is less.

The small can is at times furnished with an automatic supply of liquid from a larger tight reservoir, carried knapsack-fashion upon the back or otherwise, and having an excurrent tube conected with the inlet, *l*, of the smaller receptacle. Such a larger receptacle is represented upon the back of a person in Plate V, Fig. 1. An extension tube, *i*, is shown, and this may terminate in a reatomizing nozzle similar to the nozzles represented in Figs. 2 and 3, or the simpler form here figured which is made by closing the end of the tube and making a side perforation, *s*, at a short distance back from the end wall. By

another mode of construction the foregoing nozzles are made to discharge the atomized spray in the direction of the main axis of the blast-pipe, which is sometimes desirable, as in applying the poison to trees or in directing it horizontally or downwards. For these purposes the extension-tube may be removed entirely from its juncture, *r*, and with such a short discharge-pipe spray may be thrown immediately therefrom without reatomizing, yet a much finer quality of mist is produced by adding one of the reatomizing nozzles thereto. Again, the machine can be used by substituting a person's breathing apparatus for the bellows. In this case, as in Plate IV, Fig. 8, a blow-pipe and mouthpiece, *o*, should be added, that the mouth may be far from the poison. This is the cheaper form and may be employed by careful persons. The other parts of Fig. 8 are the same as already explained.

Finally, for similar purposes a small squirting apparatus, pictured in Plate V, Figs. 1–5, may be described. It consists of a small telescope-pump having the internal structure of the stirrer-pump elsewhere described. The cylinder, *c*, is held by one hand, and the hollow piston-rod, *x*, by the other. The piston may be held steady while the cylinder is reciprocated back and forth upon it. Being a double-acting pump, a constant pressure and stream is applied. It draws the fluid from a knapsack reservoir, *k*, or other receptacle, through the suction-hose, *h*, which is joined to the pump cylinder at *c*. The valve, which occurred in the base of the pump already described, is here inserted in the suction-hose, and by means of the hose is held in connection with the pump. Also in this case the fluid is ejected from the tubular piston-rod through its extension-pipe, *x*, *u*, and the nozzle, *s*, which is the same as those already referred to. The extension-pipe may be forked, as in Figs. 4 and 5, to apply two or more jets of spray, or it may be entirely removed when desired. Also the pump is well adapted for extinguishing fires or squirting into trees, &c., while it will supply itself by suction from a bucket or any other suitable source.

REPORT ON THE CAUSES OF DESTRUCTION OF EVERGREEN FORESTS IN NORTHERN NEW ENGLAND AND NEW YORK.

By A. S. Packard, Jr., *Special agent of the Division.*

THE LARCH SAW-FLY WORM.

(*Nematus erichsonii* Hartig.)

Order Hymenoptera; family Tenthredinidæ.

[Plate III, Fig. 1, and Plate XIII, Figs. 1, 1*a*, 2, 3, 4.]

HISTORY OF ITS RAVAGES.

In Bulletin 7 of the United States Entomological Commission we enumerated all the insects known to affect or in any way to prey upon the larch or hackmatack. There were none then known to abound upon or to seriously injure this tree, which has heretofore been supposed to be as free as even the hemlock from insect pests. The hackmatack, as is well known, is one of the most important lumber trees in Maine, as it

sends down a single large root, which grows laterally, forming a bend at right angles to the trunk, so that it is used for "knees" in building vessels, the smaller trees being used for the same purpose in boat-building.

The larch grows in wet swamps, or standing water, where the spruce or hemlock as well as pines would not flourish, hence its growth enhances the value of extensive swampy tracts in Maine, where the water often stands all summer, even through the severest droughts.

Its devastations in Maine.—Our attention was first called to this insect late in August, 1882, and we first saw the effects of its ravages at Brunswick, Me., where it had partly or entirely stripped the hackmatacks in a very wet swamp on the banks of the Androscoggin River, on the farm of Hon. C. J. Gilman, who called our attention to the ravages which had been committed earlier in the season. On examining the growth in company with him, we found that most of the trees, both large ones, 6 to 10 inches in diameter, and small saplings, 6 to 15 feet in height, had been attacked; some of the trees were stripped, others partially so, while others had wholly escaped. The trees in the middle of the swamp appeared to have suffered most, while the smaller ones on the edge or on higher land were less injured.

By jarring the trees a few young, half-grown worms of the second brood which had not yet undergone their last molt, and a single fully-grown larva were collected, while the cocoons from which the saw-flies had escaped earlier in the season were found lying upon the ground or in the moss under the trees. No cocoons with the pupa within, or any other fully-grown worms, were to be found.

On the same day (August 30) we examined a noble larch on Mr. Gilman's ground, which had been nearly killed, as he informs us, by these or similar worms.

On September 6 we found that the hackmatacks in cold, boggy, wet land on the crown of Rocky Hill, near Brunswick, had suffered more than elsewhere. Many of the trees were wholly or partially defoliated. According to Mr. Simpson, the injury was here done "about haying time," July, 1881, but the worms had been at work in June and July of the present year. The trees at the time of my visit (September 6) were putting out a new set of leaves on the terminal shoots, the needles or leaflets being from one-third to one-half an inch in length. We also noticed from the railroad train in going from Brunswick to Boston, about the middle of September, that the hackmatacks had been stripped near Portland and Saco; no trees being observed west of Saco, along the line of the Eastern Railroad.

Our attention, however, had previously been called to this insect by its ravages near Augusta, Me., where it first, perhaps, attracted general attention.

The following notice appeared in the Daily *Kennebec Journal* for July 25, 1882:

A white worm about three-fourths of an inch long is destroying the foliage of the hackmatack and fir trees in certain sections in this vicinity. The trees appear all bare and brown, as though scorched by fire.

On applying for specimens and further information to the editors, we received the following note from Mr. W. A. Newcomb, of the *Journal*, under date of July 31:

I send you to-day some of those worms that are eating the hackmatack trees. I could not find any of the large, full-grown worms, and I think they have gone into the chrysalis state. These that I send are just hatched out, and were all the specimens I could find.

Mr. Newcomb afterwards (August 21) sent me the fully-grown worms of this brood which were then at work on the trees.

The following correspondence and extracts will give an idea of the extent of the ravages of this worm in Maine. The "juniper" is evidently a local name for the hackmatack.

Another destructive pest has put in its appearance in the shape of a green worm. It preys on the juniper trees. All the juniper trees in the swamps, and the shade trees, look as though fire had scorched them; the entire foliage is eaten in a few days by millions of these worms.—*Dover Corr. Bangor Commercial*, July 28, 1882.

FOXCROFT, *August* 17, 1882.

Your card to the Commercial is before me. The worms which destroyed the juniper foliage came like a shower, and lasted about a week; they eat the trees clean, and departed all at once, no one knows where or when. I have tried to find one to-day, but could not. The worms were green, smooth, about three-fourths of an inch long, clustered together on a branch, and they ate continually, I should think, by the quick work they did in stripping the trees. No juniper escaped destruction. The lower limbs of some trees were left untouched.

C. HILL.

We are especially obliged to Charles G. Atkins, esq., Fish Commissioner, and who traveled extensively during the last summer, for information and specimens. He writes as follows:

MANCHESTER, ME., *August* 25, 1882.

The editor of the Kennebec Journal wrote me that he had sent you one batch of hackmatack worms, and was about to send you another. Doubtless you have all you need. I did not come upon specimens until too late, though now that I have once found them, I marvel that the affected trees did not sooner attract my attention. They are all about here.

I have just returned from a trip to Grand Lake Stream, Washington County, and will give you the results of my observations on hackmatack insects.

From Grand Lake Stream to Princeton, and thence to Forest Station, by stage, a distance of 40 miles, the hackmatacks (there called *juniper*) had been attacked by some insect that had shorn off the foliage of the upper part of each large tree. In all that distance I did not see a dozen trees less than 25 feet high that had been touched, but of those of 30 feet and upward in height 90 per cent. or more had been attacked at the top and denuded (almost completely) down on an average, say 8 feet or 10 feet from the top. The terminal shoots of the main stem and branches did not appear to have been eaten off, but the side whorls of leaves were mostly gone. In some cases the outer extremities of large limbs below the region generally denuded had been attacked near their extremities. There were no worms to be seen on the trees. I climbed one tree and searched it carefully, but found nothing. On descending, however, I found a larva crawling on my coat sleeve, a greenish slate color, some three-fourths of an inch long, with black head, which I send you in vial. In Hinkley Township I noticed some sphinx larvæ on hackmatack tips, and inclose one. I suppose it was feeding, but did not verify supposition.

From Forest to Bangor, wherever I saw large hackmatacks they had been generally denuded to a greater extent than on the first part of the route, and the work was worse as I approached Bangor, and a smaller class of trees had been attacked than in Washington County.

I ascertained by inquiry that the devastations extended eastward as far as Orland in that direction, beyond which I know nothing.

From Bangor westward the depredations everywhere appeared (I came by rail to Readfield), and on going to a remote part of my farm where hackmatacks grow, I find they have generally suffered, but I notice here that trees under 10 feet in height have generally *escaped*. Here I find that the dormant buds on the sides of the twigs have begun to push out a new growth, which is now one-fourth of an inch long.

I find lots of empty pupa cases in the turf under one of the trees, and send some in a vial; possibly some of them may contain pupæ. No worms to be seen now.

Mr. A. P. Buck, of Foxcroft (postal messenger on E. & N. A. Railroad) told me that they were at work in his vicinity, and had committed more havoc than anywhere on the E. & N. A. Railroad, and even small trees had been completely stripped.

Hon. Z. A. Gilbert, of East Turner (post-office), (his farm is in the northwest corner of Greene and southwest corner of Leeds, or near the Androscoggin River), says the hackmatack worms have been operating in his vicinity for three years. After the first attack the trees all leafed out. After the second some died, and now, after the third, many appear likely to die.

I showed the larva I got in Washington County to both Buck and Gilbert, and they thought it might be the same that they had seen in their sections, except that Mr. G. thought his worms were more positively green in color. He said it was characteristic of them to work first at the top of the tree, as I had observed in Washington County. Mr. G. is secretary Maine Board of Agriculture. It looks as though our hackmatack forests might be totally destroyed by this insect.

I inclose some clippings from the *Home Farm* referring to this insect.

I also send you some terminal shoots of white pine, in which you may find living specimens of a borer in three stages; I suppose it is *Pissodes strobi*. In one grove of white pine on my farm it has taken 10 per cent. of the leading shoots.

CHARLES G. ATKINS.

GRAND LAKE STREAM, ME., *February* 27, 1883.

In September, after receiving your request to send the cocoons to Providence, I examined them (hurriedly), and finding some defective ones concluded the whole lot was worthless. I went out once afterwards to get some more, but did not find them. I now think the cocoons I had were mostly sound in September or October, and possibly may be now, but my keeping them dry and generally warm all this time may have destroyed their vitality. Such as they are I mail them to you herewith.

I learned from E. C. Smith, of New Sharon, Franklin County, that the worm in question infested the hackmatacks in that town last year. Also from Z. A. Gilbert, Secretary Board Agriculture, that in August, 1882, he made a trip to Aroostook County, and, my inquiries having called his attention to the matter, he looked for indications of the presence of the hackmatack worm and saw none. He was acquainted with them at home in Androscoggin County.

Very truly yours,

CHAS. G. ATKINS.

The hackmatacks in the region near to and south and southeast of the Rangeley lakes, and near Phillips, Me., were also defoliated in the early part of the summer of 1882, as we have been informed by Dr. H. G. Miller, of Providence, R. I., who went to the lakes in August.

In the summer of 1883, we found the females laying eggs, and young hatched out late in June and early in July, from Brunswick to Phillips, about Lake Umbagog, especially at Errol, N. H., and by the middle and last of July the trees were nearly stripped of their leaves throughout Maine, and many trees were fatally injured.

Its ravages in New Hampshire.—In Franconia, as we have been informed by Prof. W. W. Bailey, of Brown University, Providence, the hackmatacks were stripped of their leaves about the middle of July, 1882; the smaller trees suffering most. The trees were observed by him August 10. We noticed at Errol, on Umbagog Lake, numerous trees which had been killed by the worms, and from the number of worms seen July 4th do not doubt that many trees in that section were at least partly stripped a week or two later.

Its appearance in Massachusetts.—We learn from Mr. Andrew Nichols that the European larches were, in 1882, attacked by "worms" in the vicinity of Danvers, Mass. In July, 1883, the worms abounded on the same trees, specimens being sent us by Mr. Nichols. We observed worms at work in July, 1883, on the European larch at Lawrence, Mass., and they were also destructive at Danvers, Mass. Prof. C. S. Sargent, director of the Arnold Arboretum, Brookline, Mass., and special agent of the United States Census, Forestry Division, writes us as follows:

I have not heard of any injury to our native hackmatacks. Three or four years ago, however, I noticed that specimens of the European larch in this immediate neighborhood were suffering from the attacks of a larva, which I gathered and submitted to Dr. Hagen. I inclose his note upon the subject.

A copy of Professor Hagen's letter is here inserted:

MUSEUM OF COMPARATIVE ZOOLOGY,
Cambridge, Mass., July 7, 1881.

The larvæ belong to the Tenthredinidæ (Hymenoptera), to *Nematus erichsonii* Hart. In the Canadian Entomologist, Vol. XIII, No. 2, p. 37, 1881, I have given a short no-

tice concerning the same, sent last year from the Arboretum. The museum is very rich in Nematus, but does not possess this species, which is very rare in Europe, and has only twice before 1840 been observed to be very obnoxious to the larch in Holstein by Tischbein and in the Harz by Saxesen. Ratzeburg, in his last work, remarked only that it is rare, but may prove to be rather obnoxious. The species is, so far as I know, not described among the United States species, surely not under its original name.

The following note by Dr. Hagen, extracted from the Canadian Entomologist, is the one referred to in the foregoing letter:

Nematus erichsonii on Larix europæa.—A large number of larvæ, very young to nearly full-grown, some probably full-grown, were sent living, with the twigs. The larvæ agree perfectly with description and figure in Ratzeburg's Forst-Insecten, Tom. III, Pl. 3, Fig. 4. The species is not represented in the collection here, neither in the larva nor in the imago state. It is not mentioned in Mr. Norton's catalogue of N. Am. Tenthredinidæ. I have to remark that the larvæ of the three other species living in Europe on Larix, viz, *Lyda laricis*, *Nematus soleus*, and *compressus*, from their description, do not agree with those sent to me. I am indebted to the Harvard Arboretum and its director, Mr. Charles S. Sargent, for these specimens.—Canadian Entomologist, Vol. XIII, No. 2, p. 37, 1881.

Its appearance in Northern New York.—Mr. George Hunt, of Providence, who is a close observer of plant and insect life, and who annually visits the Adirondack region in the vicinity of Scroon Lake, informs us that about July 25 and early in August the hackmatacks were seen to be entirely defoliated, no leaves being left on the trees by the first of August; he observed the effects of the worms at Horicon, Warren County, and Scroon Lake, in Essex County, as well as at Pottersville. The region affected was very extensive, covering many square miles in different swamps. No worms were observed in 1881. He has presented us with some of the worms, which are of full size, and do not differ from Maine specimens. They were fully grown July 28.

HISTORY OF THE SPECIES AND ITS HABITS.

Notwithstanding the efforts made to rear the larvæ of this species last summer, no perfect insects were obtained, the cocoons furnished us by Mr. Atkins having been all parasitized by a species of Pteromalus, a parasite of the hymenopterous family Chalcididæ; while of two false caterpillars which spun cocoons, neither had hatched up to the time of writing.

On referring to the great work of Ratzeburg on forest insects, the admirable colored figure of the larva of *Nematus erichsonii* which he gives exactly represents the peculiar style of coloration of our worms; we had identified it as perhaps this species, or as the young of one representing it in this country.

It appears by the foregoing extracts that Professor Hagen had examined the larva and had identified it as *Nematus erichsonii*. We are unable to find any differences in the larvæ from the figure of the European species, and the cocoons are of the size and form as figured by Ratzeburg. A description of the fully grown larva is not given by Ratzeburg. The eggs are described by Ratzeburg (after Tischbein) as about one-half a line ($\frac{1}{2}'''$) long, white, transparent, laid in a row upon and within the young larch shoots. The following is a free translation of his description of the saw-fly, which he calls the large larch saw-fly, and figures in Theil III, Pl. III, Fig 4.

4-5''' long and wings expanding 10-11.''' In sculpturing and coloring so great a similarity with *N. septentrionalis* ♂ that it would be mistaken for it, were it not for the tarsal

scoop-like dilatation in latter species; but there is in place of the wing-band, only a light shade in the largest cubital cell; both the femoral hooks and apophyses are almost clear, the wing-angle of the prothorax brownish white; the whitish femoral rings are only clear on the hinder legs, and on the abdomen at most the four middle rings are reddish-brown. The punctures are finer than in *N. septentrionalis*, especially on the scutellum and on the rather shining mesosternum.

Ratzeburg states that he himself has not observed this insect, which occurs in Germany and other parts of Europe. It appeared on the larch in the Harz Mountains as well as in the plains of Holstein. The larvæ are social, but do not occur in such thick, crowded clusters as do those of Lophyrus. The flies make their appearance toward the middle of June. The eggs are laid usually in a single row on the upper end of the young shoots, two or three sometimes being placed together along the shoot. The eggs are inserted in a little slit made by the ovipositor under the epidermis. They hatch at the end of June and early in July, and the larvæ stop eating, becoming fully grown, toward the middle of August. They then fall from the trees and spin their cocoons under the moss; here they pass the winter, and in the following May enter the chrysalis state within the cocoon, to appear as four-winged flies in June. From a forestry point of view, adds Ratzeburg, the insect might become injurious since the larvæ have already in certain seasons abounded on the larches in sufficient numbers to attract the attention of forestry officers in Holstein.

The habits of the American worm are evidently like those of the European species; and it is very probable that the insect is common to both Europe and Northeastern America. At any rate our species could not have been introduced with European larches, since its ravages have been committed in the wilder, less frequented portions of Maine, New Hampshire, and New York, as well as on the seaboard in towns long settled. In brief, the habits of our species are as follows: The eggs are laid in the terminal young shoots of the larch from about the middle of June, in Massachusetts, to the early part of July in Northern Maine, the larvæ feeding on the leaves late in June, and in July and early August. By the last of July to the first week in August, according to the latitude, the worms are nearly fully grown, while a few half-grown ones occur on the trees in Maine in the last week of August and the early days of September. It is very doubtful whether there are two broods. We will now give a more detailed account of its habits.

The eggs had all hatched by June 23–28; few were to be found at Brunswick, although the incisions made by the female were commonly observed. The female saw-fly makes about a dozen incisions in the terminal young, fresh, green shoot, sometimes in one of the side shoots next to the terminal one: judging by the shape of the hole, the eggs are of the shape described by Ratzeburg, *i. e.*, oval cylindrical and about 1.5^{mm} in length. The eggs are placed in two rows, alternating, not exactly parallel, one being placed a little in advance of the other. The eggs are inserted at the base of the fresh, soft, young, partly-developed leaves of the new shoot, which is usually by June 20–30, only about an inch or an inch and a half in length. The presence of the eggs causes a deformation of the shoot, which curls over, the incisions being in all cases observed on one (the inner) side of the shoot. In many cases a last year's shoot was observed with the scars of the incisions on the concavity of the shoot. That the incisions were made by the saw-fly was proved by finding a freshly-hatched, but dead, larva in one of the holes. Sometimes one or two of the leaves die in consequence of the wounds made at their base.

After the foregoing lines were written we fortunately observed a female in confinement, June 29, while engaged in the process of ovipositing; we should judge that the operation of sawing the slit and depositing the egg required not less than five minutes, and perhaps not much more than that length of time. The fly had been evidently at work for some time previous, as a number of eggs had been laid along the shoot; she had begun at the farther end and worked down to the base of the new, fresh, green shoot. She stood head downward while engaged in making the puncture, and was not disturbed by our removing the larch twig from the glass jar and holding it in our hand while watching the movements of the ovipositor under a Tolles triplet. The two sets of serrated blades of the ovipositor were thrust obliquely into the shoot by a sawing movement; the lower set of blades was most active, sliding in and out alternately, the general motion being like that of a hand-saw. After the incision is sufficiently deep, the egg evidently passes through the inner blades of the ovipositor, forced out of the oviduct by an evident expulsive movement of the muscles at the base of the ovipositor. The slit or opening of the incision after the egg has passed into it is quite narrow and about $1\frac{2}{5}^{mm}$ in length. While engaged in the process the antennæ are motionless, but immediately after the ovipositor is withdrawn they begin to vibrate actively, the insect being then in search of a site for a fresh incision.

After making the foregoing observations we found at Phillips, Me., July 1, and at Errol, N. H., July 4, numerous twigs containing eggs, and the flies were also observed upon the trees ovipositing. Although the slit is at first closed, as soon as the embryo increases in size the twigs swell where they have been incised by the ovipositor, and the slits enlarge and gape more or less, becoming much larger and more conspicuous than when the eggs are first deposited. It would thus appear that oviposition takes place about a week later in the vicinity of Brunswick, Me., than in Essex County, Massachusetts, and about a week later in Northern Maine and New Hampshire than on the coast at Brunswick.

When the larva hatches, the incision gapes open, leaving an oval hole. Out of this gape the larva creeps, and it rarely eats the terminal shoot, but crawls upon the leaves of the whorls next to the terminal shoot. At first it nibbles one side of the needle or leaf, leaving it half eaten and rough, serrate, and partly withered along the edge. The half-eaten, withered leaves of unequal length in a whorl on the ends of the smaller branches enable one to detect the presence of the young worms on the tree.

Usually after the young larvæ have shed their first skin, they collect on the verticils of the larch and almost invariably begin to eat the needles, one after another, beginning at the distal end and eating the leaf obliquely until only a short stump is left; in this way one verticil after another is eaten, and when the worms are half-grown they occasionally collect around the main stem of the twig in singular clumps or clusters, the hinder part of the body curled over their backs, and, owing to their oblique posture in reference to one another, appearing like a ball of worms. This singular appearance was briefly noticed by Ratzeburg. The castings or excrement are long, cylindrical, more or less truncated at each end. Our saw-fly differs slightly, as has been described, from the German in the eggs being laid at the base of the leaves on the newly-grown shoots, rather than on or just under the epidermis of the last year's shoots, where we have repeatedly and in vain searched for them. The larvæ were observed to hatch out from June 20 to 30 at Brunswick, Me.

The larvæ appear to attain their full size in about five to seven days after hatching; certainly less than or not more than ten days. There appear to be but three molts or changes of skin, *i. e.*, four stages of the larvæ. In casting the skin, the head splits open along the median line of the vertex, and the epicranium or sides of the head split apart on each side, leaving the clypeus and labrum in place; then the body is drawn out of the rent, the skin adhering to the needle or leaf.

DESCRIPTION.

The egg.—Slender, cylindrical, tapering rapidly towards each end. Length, 1.2^{mm}.

Larva at the time of hatching.—The head very large, much wider and higher than the body before the latter fills out from eating; dusky or smoky green, not black, darker in front on the clypeus and labrum than elsewhere; eyes black; thoracic legs smoky green. Body uniformly pea-green; the head and thoracic legs soon become darker, and the body fills out and becomes a little larger after the larva has taken food. Length, 3–3.5^{mm}.

Larva after the first molt.—Body pale green, without the glaucous pearly bloom of the two later stages; head and thoracic feet black; the segments wrinkled as in the adult; but the short black spines of the two later stages are not to be seen. Length, 5–7^{mm}.

Larva after the second molt.—It now has the peculiar glaucous-green bloom of the adult on the upper part of the body, the body being pale pea-green beneath and low down on the side, while the black spines on the abdominal segments are distinct and arranged as in the full-fed worm. Length, 12^{mm}.

Larva of fourth and last stage (Pl. III, Fig. 1*b*). Length at first, 14–16^{mm}. Body with three pairs of black thoracic and seven pairs of abdominal legs, the color of the under side of the body. (The larva may be distinguished from Lophyrus worms by having one pair less of abdominal legs, the latter having eight pairs.) Body rather long and slender; less plump than in the *Lophyrus abietis*. Head round, jet-black (it is usually reddish in Lophyrus); seen from in front, regularly circular, mandibles 4-toothed; maxillæ 4-jointed, the joints longer than in Lophyrus; the mala or innermost lobe broad and large at the end, with about ten stiff long setæ (in Lophyrus the mala is much smaller, with only three very short setæ or stiff spines). The body is of a peculiar glaucous-green color, like that of the under side of the leaves; the glaucous-green dorsal region is plainly separated from the paler under side of the body by a definite line. There are no lateral stripes or spots. The first three (thoracic) segments behind the head are plain, with no minute warts; but around each abdominal segment except the last run two parallel double rows of minute dark dots or warts, but with no minute short hairs as are seen in *Lophyrus abietis*, while the supra-anal plate is free from such dots and hairs. Length just before transformation, 18^{mm}.

The worm is at once distinguished from any other saw-fly larvæ, on pines, spruce, and firs, by its larger size, its color, and by its jet-black head and its seven pairs of abdominal legs.

Cocoon.—Larger and darker than that of *Lophyrus abietis*. Length, 10^{mm}; diameter, 5^{mm}.

The imago or saw-fly (5 females).—A very large, thick-bodied, black species, with abdominal segments 2 to 5, and part of the sixth bright resin-red.

Head black; maxillary and labial palpi pale whitish flesh-color. Antennæ tapering to the end, black, 9-jointed; the scape with two small short joints, the second shorter than the first; the flagellum 7-jointed, the second joint considerably shorter than the first, and slightly longer than the third; the two terminal joints of equal length and slightly paler than the rest of the antennæ. The clypeus and especially the labrum covered with white, stiff, short hairs, as also the genæ in front. Head and thorax uniformly black, under the triplet seen to be pilose. Basal segment of the abdomen black, segments 2 to 5, bright resinous red, including the basal third of the 6th, this segment beneath being entirely red.

First and second pair of legs, including the trochanters, pale flesh-color, the femora, however, somewhat reddish and tipped at the distal end above with black; the third pair of femora red, like the abdomen, black at tip; tibiæ pale, black on the outer third; tarsi black, the under spines pale, including the base of the claws. End of abdomen and ovipositor black. Wings with the costa as far as the stigma reddish; stigma and veins black. Only three subcostal cells, the basal squarish, one not being completed, a short obsolete vein projecting from near the stigma.

Length of body, 11^{mm}; of antenna, 6.5^{mm}; of fore wing, 9^{mm}; expanse of wings, 20–21^{mm}. One specimen considerably smaller than the others.

REMEDIES.

It is obvious that in swamps in the remoter parts of the country these worms cannot be subdued; they will run their course, and probably such a visitation as that of 1881–'82 will not happen again for a term of years. To prevent their killing shade trees, particularly small ones, jarring the trees will prove a good remedy, the worms once shaken off the tree cannot ascend the trunk, as they do not, like canker worms, climb trees or let themselves down by a thread. Small trees may also be showered with solutions of Paris green, or the various fluid insecticides recommended in the recent reports of the Entomologist of the Department of Agriculture.

PARASITES.

A number of cocoons sent us in 1882 by Mr. Atkins were found to be in every case tenanted by a minute chalcid parasite, belonging to the genus Pteromalus. If new it may be called *Pteromalus nematicida* (Plate XII, Fig. 8). About a hundred of these issued from the cocoons in the breeding-box during May, 1883. This parasite must therefore be a most destructive enemy of the larch worm.

We also noticed several bugs, a species of *Podisus*, near the common *spinosus*, preying upon the fully-grown worms; it ascends the trees and pierces the worm with its beak, carrying it down the tree and sucking its blood, rendering it lifeless.

THE SPRUCE-BUD TORTRIX.

(*Tortrix fumiferana* Clemens.)

Order LEPIDOPTERA; family TORTRICIDÆ.

[Plate III, Fig. 3.]

The most destructive enemy of the spruce and fir in Lincoln, Sagadahoc, and Cumberland Counties, Maine, is the Spruce Tortrix.

The habits of this insect while in confinement have been studied by Prof. C. H. Fernald, of the Maine State Agricultural College, Orono, Me., and his account published in the *American Naturalist* for January, 1881. In the account of the ravages of a caterpillar on the spruces on the coast of Maine in Bulletin 7 of the United States Entomological Commission, we refer to this insect, which we were unable to identify, as, after repeated search in the latter part of the summer, we failed to discover any traces of the insect in any stages. In our account we gave greater prominence to the operations of borers and bark beetles than to those of this caterpillar; and while considerable damage was undoubtedly done to spruces and firs in Sagadahoc and Cumberland Counties by those beetles, from farther inquiries and field-work carried on in June and July, 1883, in different parts of Maine, we now have little doubt but that the destruction of spruces and firs along the coast of the State was mainly due to the attacks of this insect.

The different climatic causes alleged to destroy forest trees in general, would, in the present case, have injured pines and hard-wood trees, as well as spruces and firs, and the destruction would have been general; whereas the trees have been killed by a caterpillar which is not known to live upon pines nor any trees but spruce, fir, and occasionally the hemlock and larch. Individual trees, or clumps of trees, were attacked,

whether in high and exposed situations or in hollows; occasionally from such centers the worms seem to have increased and spread from year to year, until all the trees in localities several square miles in extent were killed. Moreover, as we have seen in the case of the attacks of the larch worm, the defoliation of spruces and firs repeated two and perhaps three summers is sufficient to either kill the tree outright, or so weaken it that bark-boring beetles can complete the work of destruction. We are now inclined to the opinion, then, that the Bud Tortrix is the sole or at least main cause of the destruction of spruces and firs in Cumberland and Sagadahoc and Lincoln Counties, Maine, and that by their attacks they render the trees liable to invasion by hosts of bark beetles.

ITS HABITS AND TRANSFORMATIONS.

The spruce-bud worm, as we observed in Cumberland County, also at Phillips, and near the Rangeley Lakes, on the road from Phillips to Rangeley, where the trees by the roadside, as well as in the woods, were attacked by them, so that they looked as if a light fire had passed through them, feeds upon the leaves or needles of the terminal shoots, both the first and previous year's growth. The worm gnaws the base of the needles, separating them from the twig, meanwhile spinning a silken thread by which the needles and bud-scales are loosely attached to the twig, the worm moving about in the space between the twig and the loosened needles and bud-scales, and not living like many leaf-rolling caterpillars in a regular tube.

The caterpillar sometimes draws together two adjacent shoots, but this is rarely done; hence while it is at work it scarcely alters the appearance of the tree, and its presence is only known when the worms are abundant enough to partly defoliate the trees.

The worms in June, 1883, were in Cumberland County most abundant where the dead or partially dead spruces abounded; but individual worms could be obtained by beating any spruce or fir in any locality, showing that in years of immunity from its attacks the insect is a common and widespread species. We found the worms most abundant in spruces, firs, and even hemlocks, July 1 and 2, between Phillips and Rangeley, but after passing through all the Rangeley Lakes, and going from Errol, N. H., to Berlin, Gorham, Jackson, and Conway, N. H., we found that the spruces and firs throughout Northwestern Maine and the White Mountain regions had suffered no widespread damage. One and perhaps two rather extensive tracts of dead spruces were observed at a distance from the stage road near Rangeley, but throughout the vast spruce-clad forests observable from the lakes themselves no such tracts of dead trees were to be seen. On the contrary, the spruce forests of the Rangeley Lake region appeared to be as green and fresh as any forest we have ever seen. The dead spruces at the water's edge of the middle lakes were evidently due to the high water held in by the middle and lower dams during the last two years. As in any forest, there were individual dead trees, sometimes small clumps of them, where the trees had died as the results of tornadoes or of borers. The persons living by the lakes, lumbermen and others, informed us that there had been no extensive destruction of evergreen trees in this region.

The spruce-bud worm attains its full size and stops feeding, ready to transform to a chrysalis, in Cumberland County by the 20th to 30th of June, and about the Rangeley Lakes and in the White Mountain region a few days or nearly a week later.

When about to change to a pupa it remains in its rude shelter or hiding place under the loosened leaves of the shoot, where it turns to a

chrysalis, without spinning a regular, even, thin cocoon. It remains in the chrysalis state about six days. Those pupating at Brunswick, Me., June 28 and 29, issued as moths July 4 and 5. When the moth is ready to break forth from the pupa, the latter wriggles part way out of its hiding place, and the moth issues, leaving the rent pupa skin projecting half way out of the end of the shoot. The moths then appear from the first to the middle of July. July 16, after our return from an absence of two weeks, we found that the moths of both sexes had issued, and that the females had laid their eggs in curious little patches on the sides of the breeding-box. They must have issued about the 5th to 7th of July, and immediately laid their eggs, as in one patch the shells were empty, with a small orifice in the shell, out of which the larvæ had crept. Another patch was found with a dark spot in each egg showing the head of the embryo caterpillar; these hatched July 18, 19. It thus appears that the embryo develops, and the caterpillar hatches, in about ten days after the eggs are laid.

The eggs are very curious and very unlike those of most moths. They are pale green, scale-like, broad, flat beneath, moderately convex above, oval cylindrical, a little longer than broad, and in all those which I examined, both those containing the embryos, and those which were empty, the surface, contrary to Professor Fernald's statement, was under a lens seen to be finely but irregularly granulated. The shell is thin, and at first unusually soft. Length, 0.9-1.4^{mm}; breadth, 0.8-1^{mm}. The patches were about 3^{mm} in diameter, and composed of as many as 30 eggs. The eggs overlapped each other irregularly, leaving about a third or fourth of the surface of each egg exposed.

From the form and size of the egg-mass it is evidently attached by the moth to a terminal twig. The caterpillars on hatching do not, as Fernald observes, eat the shell. They hatch about or soon after the middle of July, and it is most probable that the caterpillars become partly, perhaps almost wholly, grown before the end of autumn, and pass the winter among the terminal shoots of the tree, to finish their transformations the following June and July. It is certain that there is but a single brood of caterpillars. Professor Fernald, in his article in the *American Naturalist*, describes the process of egg-laying. He has bred from the worms an ichneumon (*Pimpla conquisitor*), several dipterous parasites and a hair-snake. We have found the insect to be remarkably free from parasites, having bred about 25 of the moths without rearing any parasites.

DESCRIPTIVE.

Larva, first stage.—When first hatched the young caterpillar is uniformly pale pea-green, with a yellowish tint. Head dark brown, but the cervical shield pale amber, with two dark dots on the hinder edge; hairs nearly half as long as the body is thick; length 2.5^{mm}. At this time the young worms are very active, letting themselves down by a thread as readily as when fully grown.

Larva before last molt.—Body not quite so thick as full-fed worm; more uniformly rust-red brown; the piliferous warts duller in color, sometimes not much paler than the rest of the body towards the head, though higher and more distinct towards the end of the body. Head black and prothoracic shield black, the latter pale on front margin; no well-marked, broad, lateral, yellowish-brown band such as characterizes the adult. Length 12–13^{mm}.

Larva (full-fed).—Body unusually thick and stout, tapering gradually from the middle to the end, and slightly flattened from above, as usual; head not quite so wide as the body, of the usual form, dark, almost black-brown, but lighter than before the last molt; mouth-parts dark, with paler membranous rings at the articulations; antennæ with the terminal joint black.

Prothoracic shield pale brown, paler than the body, with a pair of dark blotches on the hinder edge in the middle, and other scattered, smaller, dark, irregular blotches, of which two are situated in the middle of the front edge, the latter pale whitish.

Body rich umber-brown, diffused with olive-green, especially on the sutures; with

very conspicuous and showy, large, whitish-yellow, piliferous warts, forming flattened minute tubercles, with a dark center from which the hair arises. On the top of the second and third thoracic segments is a transverse row of four such warts on each segment; on the upper side of the abdominal segments are four warts arranged in a short trapezoid; they are far apart transversely, but unusually near together antero-posterior to the body; on the penultimate segment is a median, broad, light-yellowish spot on the hinder edge of the segment; a large, round, convex area, forming the supra-anal plate, from which arise about six fine, long, pale-brown hairs. Anal legs spreading, with two or three piliferous callosities; the terminal segment and anal legs concolorous, with an irregular, broad, pale-yellowish, lateral band reaching to the prothoracic segment, and slightly tinged with ferruginous. In this band, on the side of each segment, is a pale-whitish, flattened wart, directly in front of and adjoining the spiracle; along the narrow, lateral, fleshy ridge on each segment is a long, narrow, pale-yellowish wart. Beneath dull, livid greenish, with (on each segment) a transverse row of four bright-yellowish warts, concolorous with those above; the two inner ones are minute, the outer ones much larger. Thoracic legs black-brown; the four pairs of abdominal median legs are pale, almost whitish; all the hairs are fine and light-brown in color, and one-half as long as the body is broad. Length 19^{mm}.

Pupa.—Body very thick, the thorax especially unusually swollen; the body, soon after changing, pale horn-colored, striped with brown; antennæ and legs dark horn-color or dull tan-brown; wings pale, with the veins dark; the thorax pale horn, spotted with dark tan-brown, with three irregular, dark, dorsal stripes; meso-scutellum and metanotum dark; abdominal segments above, with two rows of stout spines; a lateral row of dark spots, and a median spot on the two basal segments; similar spots on the succeeding segments lengthened and connecting the lateral spots. Beneath are two irregular rows of diffuse spots; the hinder edge of the segments darkened; the terminal segment uniform dark, shining, tan-brown, ending in a long, stout point, on each side of which are two tightly-curled spines, and two stouter but less curled larger ones at the end, arising from a common base. Length 12^{mm}.

The moth.—A large species, with a stout body, and large broad, oblong fore wings; the costa not excavated towards the apex, but full and regularly though slightly curved, the apex being rectangular; head and body umber-brown. Palpi very stout; terminal joint short. Fore wings umber-brown, the brown sometimes replaced by rust-red; ground-color bluish-slate; on the inner fourth of the costal edge are four unequal, triangular, brown spots, the second and fourth connecting with an elongated transverse brown patch in the middle of the wing. From a point at or just within the middle of the costa a very oblique, distinct, broad, brown band crosses the wing in a zigzag course, ending at or near the outer third of the internal edge of the wing. This broad band extends out towards or connects with a pre-apical brown patch on the costa; it also sends an angle inwards behind the median vein, and again another angle outward opposite the inwardly-directed angle. There are often two distinct, costal, whitish dots (sometimes wanting) just before the apex, while the apex itself is brown. There is also a large brown patch in the middle of the wings near the outer edge. There are numerous fine, short, transverse, brown lines dividing the wing into squares or checks, bordered with brown. The bands and short lines are more or less confluent or separate, varying much in this respect. Some females differ in the umber-brown being bright rust-red, and the clay-blue pale ferruginous brown, while the broad, median, zigzag band is umber-brown on the edges and bright rust-red in the middle, and the wing is covered with an irregular network made by the short transverse and longitudinal dark-brown lines enclosing rust-red or smoky-red patches.

Legs, body, and hind wings glistening umber-brown; tarsi ringed with pale brown. The abdomen of the female is very stout; that of the male ending in a long, distinct, hairy tuft. Described from perfectly fresh specimens, 5 ♂; 8 ♀. Length of body $9-10^{mm}$; of fore wing $10-12^{mm}$; expanse of wings $19-23^{mm}$.

THE SPRUCE NEMATUS.

(*Nematus integer* Say.)

Order HYMENOPTERA; family TENTHREDINIDÆ.

[Plate XIII, Figs. 6, 6*a*, 6*b*, 6*c*.]

Although this insect is not, so far as known, especially destructive to evergreen trees, yet it is common over the Northern States and may at times prove obnoxious. It occurs on the spruce in Maine in the latter part of summer, and feeds separately, not being gregarious as in most

species of Lophyrus or the Larch Nematus. It is possible that the fly escapes from the cocoon in the autumn, but as a rule it without doubt passes the winter in the cocoon, the fly making its appearance in the late spring and early part of June, specimens having been found dead in the breeding-box in the middle of May.

DESCRIPTION.

The larva.—The body is long, broader than the head; pale pea-green; of the color of the leaves of the spruce among which it feeds. The head is smooth, of the same color as the body, with a dark patch extending upward behind each eye. Body not spotted, but with a dorsal dark green stripe, bordered on each side with whitish glaucous green. Along the body is a lateral conspicuous broad white stripe, the stripe much scalloped below. Body beneath, and abdominal legs, uniformly green; thoracic legs pale honey yellow, except at base. Length 17^{mm}.

Cocoon.—Of the usual oval cylindrical form; of a pale horn color, of the usual density, the walls being opaque. Length 13^{mm}; diameter 4^{mm}.

The saw-fly (*imago*) [2 females].—Antennæ 9-jointed; flagellum minutely hirsute, 7-jointed, the two basal joints of flagellum equal in length; head and body dull amber yellow (testaceous); eyes black; ocelli situated in a dark-brown patch; a black irregularly triangular spot above the insertion of each antenna, being situated in a pit between the eyes and the inner edge of the broad orbits. A single minute triangular black spot between the antennæ; clypeus, labrum, and palpi pale dull amber (testaceous), concolorous with the head; the mandibles dark at tips.

Prothorax above not spotted. Mesonotum with three longitudinal, dark, broad stripes; præscutum dusky reddish brown, pale on the sides; on the middle of each half of the scutum a broad blackish band reaching the front edge, but not extending posteriorly behind a point parallel with the apex of the scutellum. Behind and between the ends of these dark bands are two small dark spots. Scutellum on the posterior half dark brown; the metascutum is black. Sides of the thorax and beneath pale faded amber (testaceous), with a triangular black spot on the sides of the prothorax below and in front of the wings.

Abdomen of the same color as the rest of the body, but on the sides and beneath with a greenish tinge; above black, especially towards the base, next to the thorax; the segments above being banded transversely with black on segments 1–8, the bands growing shorter (transversely) behind, until on the 8th segment the dark band is scarcely wider than long; the black bands extend on each side of the front edge of each segment, forming a point on each side. Under side of meso- and metathorax a little dusky.

Fore and middle pair of legs testaceous; extreme tips of tibiæ and tarsal joints with a very narrow black ring; last tarsal joint with the pad (pulvillus) and end of claws dark. Hind legs: femora in color testaceous; tibiæ a little dusky, paler towards the femora; all the tarsal joints equally dusky. Ovipositor at base reddish horn color, tip blackish. Wings with the veins blackish brown; costal edge paler; stigma dark testaceous; 4 subcostal cells, the 1st or innermost 4-sided, subquadrate. Length of antenna 5^{mm}; length of body without antennæ 8^{mm}; length of a fore wing 8^{mm}.

NOTE.—This agrees in all respects with Mr. Norton's description of *Nematus integer* Say, var. *a* (Trans. Amer. Ent. i, 216). It is recorded from Maine, Massachusetts, Connecticut, New York, Pennsylvania, and Indiana. It thus seems to be a widely distributed species. It is closely allied to Say's *N. vertebratus* and to Norton's *N. trilineatus*, but the pale fore and middle tarsi and the greenish tint distinguish it. The description of the larva is taken from Bulletin 7, U. S. Ent. Comm., p. 234, No. 20.

THE HEMLOCK GELECHIA.

Gelechia abietisella, n. sp.

Order LEPIDOPTERA; family TINEIDÆ.

[Plate III, Fig. 2; Plate XIII, Figs. 7, *7a*, *7b*.]

During the spring of 1883, the hemlock trees, large and small, in the vicinity of Providence, R. I., were observed to be much disfigured by the attacks of a small Tineid worm, causing sere and dead patches of leaves on the smaller branches and twigs of both large and small trees.

The small pale-green caterpillars bite off from six to eight leaves, constructing a broad flat irregular case; the leaves on being separated from the twig turning red or yellowish, thus forming a conspicuous patch. This rude case is held together with silk, the worm living in a rude silken tube, and feeding upon the inside of the leaves. The length of this tube, within which the little caterpillar finally changes to a chrysalis, is from 8 to 10^{mm} in length.

The worms are found from the first of May through the month of June. One changed to a pupa in its tube about the 20–25th of May, and the moth (in confinement) appeared June 1. Other chrysalids were found in the tubes from June 20 to 30, the moths making their appearance early in July.

The moth is beautifully marked, and probably examples occur throughout the summer. Without doubt the eggs are laid on the twigs or leaves in the summer, and the caterpillars become almost full-fed before the winter, hibernating in their cases, becoming active in the spring. The worms are preyed upon by an ichneumon, the oval cocoon with one pupa which had recently transformed, and another ready to imaginate occurring in the cases June 9th.

DESCRIPTIVE.

The full-grown larva.—Body slender, cylindrical, not flattened. Head of the normal form, not modified in shape as in leaf-mining larvæ; not so wide as the body, smooth, amber colored. Body tapering slightly towards both ends, pale green, of the same hue as the under side of the leaves of the hemlock. Cervical shield well marked, greenish amber. Each segment is dorsally divided by a transverse suture into two slight folds, on the anterior and larger of which are four dark green piliferous warts arranged in a straight line, and two on the hinder division or fold. There are similar warts on the sides and beneath. Legs 6+8; the thoracic feet are pale, blackish at tip. The four pairs of abdominal legs are concolorous with the body. The supra-anal plate amber-green, with a few long setæ, as long as the body is thick. Length 6^{mm}.

Pupa (alive).—In form slender, spindle-shaped, the head considerably narrower than the body, gradually tapering from the thorax to the end of the body; antennæ and wings reaching to the hinder edge of the 5th abdominal segment. End of the abdomen rather blunt and rounded, with a few very fine hairs. Along the side of the abdomen a row of short, thick spinules, one on the side of each segment, none on the back; a pair of such spines on the under side of the 6th segment. Eyes reddish; body pale amber, with a greenish tint on the thorax. The two terminal segments darker than the rest of the abdomen, and concolorous with the head. Length, 4–5^{mm}.

The moth.—Rich buff-yellow, with rich golden and white scales. Head and thorax white, with a few buff-yellow scales. Palpi buff-yellow, with the basal joint somewhat blackish on the upper edge; terminal joint long and slender, with two black imperfect rings, the tips acute, white; eyes black. Antennæ black, with numerous fine white rings; they scarcely taper to the tip. Fore wings long and narrow, of nearly the same width throughout; the outer edge much rounded; the fringe at the outer angle long and dense; buff-yellow, with white and golden scales; costa black at base; beyond are three large, nearly equidistant, long black costal spots more or less connected on the extreme costal edge; three equidistant black points on the submedian vein, the first situated opposite a point half way between the two basal costal spots; the second opposite the end of the second costal spot, and the third opposite the third costal spot; the third spot is sublinear and ends on the edge of the wing at the internal angle. On the costal part of the apex of the wing is a curved row of four black spots, the fourth situated at the extreme apex of the wing, and on the outer and hinder edge are two or three minute black dots, between which and the fringe is a white patch, the fringe being also streaked with white. All the black spots are more or less edged on one side with white scales. The fringe on the outer costal half is lead color with minute black scales at the apex of the wing. Below and within, the long silky fringe is much paler. Hind wings very narrow, almost linear at tip, and with the fringe concolorous with the fringe of fore wings below and within the apex. Body and legs pale glistening buff-yellow. Hind tibiæ long, with a wide fringe; first pair of tibial spines twice as long and about one-half as thick as second pair; the tarsi ringed with black and white. Length of body 5^{mm}; of fore wing 5^{mm}; expanse of wings 11^{mm}.

REPORT OF PROGRESS IN EXPERIMENTS ON SCALE-INSECTS, WITH OTHER PRACTICAL SUGGESTIONS.

By H. G. Hubbard, *Special Agent of the Division.*

SOAP EMULSIONS.

Further experiments with kerosene emulsions prove that various soaps can be readily made to combine with the oil, and that the soap and kerosene emulsions are as effective as those formed with milk. The use of soap materially reduces the cost, except where milk is abundant and cheap, as is very seldom the case in Florida.

Common bar soap, soft soap, and whale-oil soap have been tried and found to be almost equally good. Whale-oil soap, when of good quality, may be preferred, as it is stronger, and adds to the insecticidal properties of the emulsion.

The following formula is one which has proved in practice useful where a moderate quantity of emulsion is required. It gives a wash of sufficient strength to kill the eggs of the scale-insects commonly found in Florida:

KEROSENE AND SOAP EMULSIONS.

Formula.

Kerosene	2 gallons	= 67 per cent.
Common soap or whale-oil soap	½ pound	= 33 per cent.
Water	1 gallon	

Heat the solution of soap and add it boiling hot to the kerosene. Churn the mixture by means of a force-pump and spray-nozzle for five or ten minutes. The emulsion, if perfect, forms a cream, which thickens on cooling, and should adhere without oiliness to the surface of glass. Dilute, before using, one part of the emulsion with nine parts of cold water. The above formula gives 3 gallons of emulsion and makes, when diluted, thirty (30) gallons of wash.

The percentage of oil can be increased considerably without danger to the plant, and a stronger emulsion may, in fact, be required in coping with some of the *Aspidiotus* scales, upon which we have had no opportunity to experiment. But the amount of kerosene in the emulsion cannot be greatly reduced without weakening too much its power as an insecticide.

The amount of soap may also be varied, but less than one quarter ot a pound to the gallon of water forms an unstable emulsion.

After another year of experiment and practical experience in the use of kerosene emulsions as a remedy for scale-insects we see no reason to change the opinions expressed in former reports.

The distrust of kerosene naturally felt at the outset has in time given place to confidence, and the emulsions are now widely used by orange-growers in Eastern Florida. Many groves treated with kerosene emulsions have been under our own observation, and the results have been uniformly beneficial. Want of thoroughness in applying the wash, however, frequently renders repeated applications necessary.

The invention and introduction of the cyclone nozzle by the Department of Agriculture greatly diminishes the labor of applying the liquid to orange trees and insures success with ordinary care and attention, at

the same time reducing to a minimum the amount of liquid required and the expense of an application.

No case of loss or permanent injury resulting from the use of kerosene emulsions has come to our knowledge, although the reckless use of emulsions imperfectly formed, or of unnecessary strength, may be expected to cause defoliation and a temporary shock of greater or less severity.

There seems no longer any reason to doubt that in kerosene properly emulsified and diluted we have a nearly perfect remedy, more effective than any other insecticide in destroying scale-insects and having as slight an effect upon the plant as can probably be expected from any remedy with sufficient penetrating power to reach and kill the eggs of these insects.

In regard to the physiological action of kerosene upon the orange, careful observations have been made during the year. They confirm the opinions hitherto expressed:

1st. That kerosene differs from most other remedial agents in being entirely harmless to tender young growth, blossom buds, and young fruit. It may therefore be applied to bearing trees at seasons when other insecticides would cause more or less loss of growth or of fruit.

2d. That the shock produced by an overdose is felt more severely upon devitalized portions of the plant, and is not appreciable where there is full vigor. This shock is quickly followed by a healthful reaction, and is not ordinarily attended with any serious consequences, such as hardening of the bark, &c.

3d. That extremes of heat and cold increase, sometimes to an injurious extent, its action upon the plant. Applications made in the hot sun, during the middle of the day, are observed to cause a greater amount of defoliation than would result from the same application made at evening or in the shade.

In winter, when the air is charged with moisture and the nights are cold, with frost or heavy dews, the oil does not evaporate as rapidly as in warm or dry weather. Applications made under such atmospheric conditions sometimes prove unexpectedly severe and cause the tree to shed all its leaves or even kill a portion of its branches.

The most favorable season for applying kerosene washes is undoubtedly early spring or as soon as all danger of frost is past. The shedding of the last year's leaves, which takes place naturally after the orange tree has renewed its foliage in spring, is often accelerated by the action of the oil, which is thus made to appear very severe. But the loss of old and devitalized leaves is of slight consequence, and in the case of badly infested trees is a positive advantage, as the leaves in falling carry with them the scales most difficult to reach with insecticides.

Application of liquid insecticides; fineness and force of spray.—In dealing with an enemy so thoroughly protected as are many of the bark-lice liquid insecticides should be applied in as fine a spray as possible, or at least in moderately fine spray, driven with considerable force, in order to increase to the utmost their penetrating power. The aim should also be to reach and thoroughly wet every portion of an infested tree, so that no individual scale insect shall escape the action of the liquid. This result is not attainable by the old method of sending a jet from a distance into the tops of the trees. An ordinary garden syringe is practically useless. There is needed a force-pump and a nozzle giving a finely atomized spray. This nozzle should be attached to a sufficient length of flexible hose to allow it to be introduced into the top of the

tree. The orifice of the nozzle should be directed at a right angle to the hose, and not in line with it. The jet of spray may thus by a turn of the wrist be directed upward or downward, and brought into contact with all parts of the foliage and branches, from beneath as well as from the upper side.

The cyclone nozzle.—A nozzle which answers the above conditions and is easily attached to any force-pump by means of a rubber tube is described in the report of the Entomologist (Department of Agriculture, 1881–'82, page 162). It consists of a shallow, circular, metal chamber soldered to a short piece of metal tubing as an inlet. The inlet passage penetrates the wall of the chamber tangentially, admitting the fluid eccentrically, and causing it to rotate rapidly in the chamber. The outlet consists of a very small hole drilled in the exact center of one face of the chamber. The orifice should not be larger than will admit the shaft of an ordinary pin. Through this outlet the fluid is driven perpendicularly to the plane of rotation in the chamber. Its whirling motion disperses it broadly from the orifice, and produces a very fine spray, which may be converted into a cloud of mist by increasing the pressure in the pump. The perforated face of the nozzle chamber is removable for convenience in clearing the orifice when it clogs. The diameter of the chamber inside need not exceed one-half inch, and its depth one-quarter inch. A nozzle of these dimensions attached to the Aquapult pump covers one and a half square yards of surface at a distance of 4 or 5 feet from the orifice. The amount of dispersion depends somewhat upon the thickness of the perforated face of chamber. The diameter of the cone of spray may be increased by countersinking the exit hole and making its edges thin.

Half-inch gum tubing is sufficiently large to supply one or a gang of several nozzles. The tubing must be strengthened with one ply of cloth.

In use, the end of the hose is supported by being fastened to a light rod of wood, which forms a handle, by means of which the nozzle may be applied to all parts of the tree. For full-sized trees a rod long enough to reach nearly to their tops must be used. For this purpose a convenient device may be made by passing the small rubber hose through a hollow bamboo rod of the required length. A three-sixteenth brass tube inserted in a bamboo rod has also been used.

Cost of kerosene wash.—The following is the estimated cost for a standard wash of whale-oil soap and kerosene emulsion containing 67 per cent. of oil, and diluted 1 to 9:

Kerosene, 2 gallons, retail at 20 cents	$0.40
Soap, ½ pound, retail at 10 cents	5
Water, 1 gallon	
Emulsion, 3 gallons	45

At wholesale rates, 18 cents for kerosene and 8 cents for soap, three gallons of emulsion cost 40 cents=13⅓ cents per gallon. One gallon of emulsion=10 gallons of diluted wash; cost 15 cents. Cost of wash per gallon, 1½ cents.

With the "Aquapult" pump and "Cyclone" nozzle, four gallons of wash is sufficient for thirty nursery trees of one and two years from the bud. Cost per tree, two-tenths cent.

Trees which have been transplanted and have made two years' average growth in the grove (3 or 4 years from the bud) require about two-thirds of a gallon of wash. Cost, 1 cent per tree. Bearing trees of full size will require from five to ten gallons of wash. Cost, 7 to 15 cents; average about 10 cents per tree.

RECENT EXPERIMENTS.

In some experiments made in 1881–'82 with concentrated lye, and which have been given in a preliminary report already published (Department of Agriculture Report, 1881–'82, p. 106, *et seq.*), the substance was found to be almost worthless as a remedy for scale-insects and failed to kill any of their eggs. We have since learned that the lye used in these experiments consisted of caustic soda and not of potash, as was then supposed. The word "Soda" should therefore be substituted for "potash" where it occurs in that report. (See *l. c.*, p. 118, and table 6, p. 126.)

POTASH.—We have recently made some experiments with genuine potash, and find it to be much stronger than the soda lye. A table of the results, in which the experiments with soda lye are included for the sake of comparison, is given below. The brands compared are the American Company's Concentrated Lye, composed chiefly of caustic soda, and Ball Potash, Hercules brand.

Actual trial of potash lye does not materially change the verdict already pronounced upon it, under a misapprehension, and when caustic soda was the real subject of experiment. Although considerably stronger, pound for pound, than the soda, potash is not really more effective as a remedy for scale-insects, the adults and eggs of which are killed only by powerfully caustic solutions, such as utterly destroy all the more tender portions of the tree. When an application of potash does not entirely kill the bark, many of the insects and their eggs will be found to have escaped destruction. The following synopsis of the experiments with potash sufficiently indicates the heroic nature of the remedy:

Experiment No. 90.—Solution, 1½ pounds potash to 1 gallon water. Applied in fine spray to two thrifty young trees, about four years old. Leaves and tender shoots wilted visibly and changed color during the application, showing, a few minutes later, spots of brown. Two days after the application all the leaves were dead and dried up as if by fire, and remained adhering to the branches. Young growth entirely killed and pitted with holes. Three weeks later all branches under one inch in diameter were found to be entirely killed, the bark of larger branches partly destroyed, the bark of trunk blackened and hardened, but not destroyed. Upon the latter buds had begun to appear. Upon those portions of the tree where the bark was entirely destroyed the insects themselves were destroyed, but one-tenth of the scales upon the dead bark contained living eggs. Where the bark was not entirely destroyed half of the coccids and more than half of their eggs escaped. The tops of both trees were killed and their shape and symmetry ruined. A 40 per cent. kerosene emulsion would have been as effective in destroying the scale-insect, and would have had no appreciable effect on the tree. A 67 per cent. emulsion, which would have exterminated the insects, would have partially defoliated the most thickly infested branches, without affecting the vigorous portions of the tree.

Experiment No. 91.—Solution, 1 pound potash to 1 gallon water. Applied to two small trees very badly infested with scale-insects. Owing to the enfeebled condition of the trees, the effect of the lye was as severe as in the preceding experiment. Five weeks later one of the trees was recovering, the other dying, and scale-insects in both cases increasing.

Experiment No. 94.—Solution, two-thirds pound potash to 1 gallon

water. Applied to several young trees. Nearly all the leaves dropped and many branches killed.

Experiment No. 92.—Solution, one-half pound potash to 1 gallon water. Applied to two small trees badly infested with Long Scale. Both trees badly, one completely, defoliated. Tender bark and smaller branches killed. Four or five weeks later the trees were recovering, but young brood of scale-insect had thickly coated all the living branches.

Experiment No. 95.—Solution, four-tenths pound potash to 1 gallon water. Applied to a tree of medium size and in good condition. Great injury to foliage and tender bark. One month later the trees were recovering, but scale-insect increasing.

Experiment No. 93.—Solution, three-tenths pounds potash to 1 gallon water. Devitalized branches completely defoliated; other portions less severely affected. Bark blackened and hardened. One month later trees recovering; scale-insect not diminished in numbers.

Experiment No. 96.—Solution, one-fourth pound potash to 1 gallon water. Applied to a vigorous tree. Tree not severely defoliated. Four weeks later scale-insect increasing.

Experiment No. 86.—Solution, one-sixth pound potash to 1 gallon water. Applied to a tree rather badly infested, but still vigorous. Tree slightly defoliated. Scale-insect not checked and no eggs killed.

Experiments with soda lye.—The strongest application of soda lye, two-thirds pound to 1 gallon water, was not more severe in its effects upon the tree than one-half this amount of potash applied in Experiment No. 93. The bark was blackened, but not destroyed, and the tree was severely defoliated. The application had no permanent effect in removing the scale-insects, but these were afterwards destroyed by an application of kerosene emulsion, and the tree in consequence fully recovered its vigor. The remaining experiments with soda lye—1 pound to 2, 1 pound to 2½, and 1 pound to 3 gallons of water, respectively (Nos. 43, 44, and 45), failed to check the increase of the scale-insect. One year later these trees had lost instead of adding to their growth and appeared to be in dying condition, the presence of the insects having prevented a recovery from the effects of the lye. The scale-insect has since been removed by applications of kerosene and the trees are now improving rapidly.

INTRODUCTION AND SPREAD OF SCALE INSECTS.*

In the wide range of insect life few forms possess a greater vitality than is found among the bark-lice, and none are more readily transported upon plants from place to place and from one country to another.

Whenever orange plants are imported from infested districts scale insects will be brought with them, and their introduction and spread in regions where they were before unknown are inevitable. Even the soft and unprotected Coccinæ sustain without injury an astonishing amount of rough handling and exist for long periods of time without food or moisture. During the winter of 1882–'83 specimens of the common "mealy-bug" (*Dactylopius adonidum* Linn.), sent through the mails in a common letter envelope from Southern Italy, arrived living in Florida, having been more than a month on the way. In this case a few individuals were crushed between the dry orange leaves inclosed with them,

* This is extracted in advance from Chapter VI of the special report now being prepared by Mr. Hubbard.

but many, even of the adults, were found to be uninjured, and some of them had produced eggs and young in transit.

The scale-covered Diaspini are, of course, still better adapted to sustain long voyages, and their eggs are not affected by long-continued drought nor by sudden changes of temperature.

It can hardly be doubted that all the common bark-lice found upon the orange in Europe have been many times imported into Florida and California upon living plants. In this way it is supposed, in the year 1835, the common Long Scale (*Mytilaspis gloverii*) was introduced, first at Jacksonville and subsequently at Saint Augustine, from whence it spread devastation over all the groves in the State. In 1855, according to Glover, the Purple Scale (*Mytilaspis citricola*) was introduced into Florida on some lemons sent from Bermuda. More recently a new and very destructive scale has made its appearance at Orlando, in Orange County, Florida, and is slowly but surely spreading to other parts of the State. This is the Red Scale of Florida (*Aspidiotus ficus* Ashm.) It was first observed in a grove near Orlando, in the spring of 1879, upon a sour orange tree brought from Havana, Cuba, in 1874. Professor Comstock (see Department of Agriculture Report, 1880, p. 300) received specimens from Havana, and learned that it was a very common pest in the public gardens of that city.

In California, owing to the very direct communication with China and Japan, and frequent importations of plants from these countries, many destructive species of bark-lice have been introduced upon fruit and shade trees. Some of these are the most serious pests of their kind; many have a wide range of food-plants, including also the orange, and one at least, the Red Scale of California, is peculiar to citrus plants. It was introduced into California from Australia. Professor Comstock believes this to be the most destructive species known to infest citrus plants in this country. Its introduction into Florida, together with others now ravaging the groves of California, is greatly to be feared, and is probably only a question of time, as the interchange of plants between these two States increases annually.

Not only plants of the citrus family, but many other trees and shrubs, and notably the olive, may cause the introduction of scale insects, some of which have, besides the orange and its kind, a great variety of food-plants.

It would be well for the horticultural interests of Florida if some system of inspection of imported fruit trees could be adopted and vigorously enforced by the State. This would no doubt be difficult of accomplishment and perhaps impracticable. Individual importers should, however, be made fully aware of the danger which exists of introducing other destroyers more serious than those already at hand, and should be on their guard. Living plants received from foreign countries ought to be carefully cleaned upon their arrival and all insects found upon them destroyed.

It is not easy to estimate the extent of the damage that would be occasioned should any of the Aspidiotus scales now ravaging the groves and orchards of California be permitted to obtain a permanent foothold in Florida.

Precautionary measures; infection from nursery stock.—What has been said as to the danger of introducing exotic scale insects by importations from abroad will apply as well to the spreading of domestic species by the exchange and sale of nursery stock.

It must be acknowledged that many of the leading nurserymen are fully alive to the necessity of establishing and maintaining a reputation

for painstaking care, and rarely send out infested plants. Others exercise less care and frequently scatter insect pests by means of the befouled plants they distribute.

Close planting in the nursery is a most frequent cause of the appearance of scale insects in destructive numbers. Young orange trees are planted a few inches apart in rows, and are often left for years in close ranks, with their branches interlocking, and affording easy passage for the migrating young of bark-lice, so that if they effect a lodgment upon any plant, the entire row, and even the whole nursery, is quickly overrun by them.

The crowding of the plants prevents free and vigorous growth; they are stunted, and for want of nourishment, as well as lack of light and air, they are thrown into a condition in which they are particularly liable to the attack of scale insect. In common parlance "they breed scale."

In the existing almost universal distribution of the pest, those nurseries only can be kept from becoming foul in which a reasonable amount of space is allowed to each plant for its growth and cultivation. At least 18 inches should intervene between the plants, and the rows should be not less than 3 feet apart. Experience teaches that it is easier to keep clean and uninfested a large, well-ordered nursery than it is to remove the scale insect from a single orange tree of moderate size when once the pest has become fully established.

No part of the grove is so liable to suffer neglect as the nursery, and it is unfortunately a very common practice to allow seedling plants to grow up without attention in neglected corners, and frequently to become so foul with scale as to become a source of infection to the groves and nurseries in the vicinity.

To this neglect undoubtedly is due the fact that the advance of insect pests has fully kept pace with that of the orange industry in the recently occupied districts, both in Florida and in California.

Protection afforded by hedges and forest trees.—It is a serious evil, and one as yet hardly appreciated, that in Florida, in removing the forest to make way for the advancing orange groves, every tree is generally sacrificed. Not even in the lanes and roadways has the ax spared an occasional pine to serve as a wind-break against the sweep of storms. In many districts, once well clothed with timber, the naked land for many miles now lies exposed to the destructive force of gales, which, by whipping and thorning the fruit, will, when the groves begin to bear, occasion severe losses.

The pines of the original forest, from their great height, serve to break the force of upper currents, and a single giant tree extends its protecting influence over a wide area. If cut, the loss is well nigh irreparable; many generations must elapse before its place can be satisfactorily supplied by the lower and more spreading oaks and pines of second growth. But a discussion of this subject, though of sufficient importance to horticulturists, would be out of place in the present treatise, were it not for the great value of wind-breaks as an aid in isolating and preventing the spread of scale insects and other pests of fruit trees.

From the time of their first appearance it has been remarked that scale insects spread most rapidly in the direction of prevailing winds. This phenomenon is now known to be due to the influence of the wind in guiding the flight of other insects which transport the minute, crawling young of bark-lice upon their bodies.

This influence of the wind is particularly potent in guiding the migrations of spiders. For, although wingless, most species, by means of the buoyancy of their web, and the power which they possess to reel it out

upon the wind, are enabled to bridge long gaps from tree to tree, and even to imitate the flight of winged animals. The gossamer spider makes its aerial voyages clinging to a light tangle of web, which, like a parachute, is borne to great distances by the wind. Many species have this habit. Some, however, spin long lines of web, which are cast out upon the wind to a distance of several hundred feet, until their buoyancy becomes sufficient to sustain the weight of the spider, or until the ends in their sweep become entangled in the branches of a bush or tree, and they then form bridges upon which the spiders readily cross.

The warm ascending currents of spring, the southeast trade winds in Florida, excite multitudes of spiders to set out upon their travels, directing their course and speeding them on their way. At this season of the year scale insects are likewise in restless activity. The young are at this time produced in greatest abundance, and the leaves and branches of infested trees swarm with them.

The bodies of other and larger insects and the feet and tail-feathers of birds are invaded by the crawling lice, and the latter are thus borne with them in their flights to be scattered over new plantations.

The leaves and branches of shrubs and trees standing to the windward of a grove protect it by receiving these pest-laden visitors and detaining them long enough to relieve them of the scale-larvæ they bear upon their bodies.

It is, therefore, a great protection to leave narrow belts of timber between adjoining groves, allowing the undergrowth to spring up and form a natural screen, or else to replace this with cultivated plants. Fences may usefully be replaced by thorny hedges, which will aid in maintaining an effective quarantine against invasions of scale insect and other minute pests.

To be of value the screen or hedge should, of course, be composed of such plants as are not themselves subject to the attacks of orange insects; otherwise it may first become infested and afterward prove a source of danger, in place of a safeguard. For example, the oleander is not desirable in the neighborhood of orange trees, because of its liability to the attacks of certain soft scale insects (*Lecanium*). On the other hand, pines, cedars, and other coniferous plants having very few insect enemies in common with other plants, are absolutely safe, and are also admirably adapted to form wind-breaks.

THE IMPORTED ELM-LEAF BEETLE.

(*Galeruca xanthomelæna** Schrank.)

Order COLEOPTERA; family CHRYSOMELIDÆ.

[Plate XII, Fig. 3.]

The depredations of this pest have now become widely extended throughout the Northeastern States, rendering almost worthless and unsightly those most valuable shade trees of our cities—the elms. As its injuries are so far unknown in the Mississippi Valley, the blighted appearance of the elms on the Department grounds in midsummer, and especially of the European varieties, at once attracted our attention when we first came to Washington, and a series of experiments was begun

* This is the *Galeruca cratægi* Forst., and *G. calmariensis* Fabr. In Crotch's Check-list it appears as *Galerucella xanthomelæna*.

with a view of checking the ravages of the insect. The excellent opportunities thus offered for experiment and study have since been improved, and, with some prefatory passages in relation to the history and habits of the beetle, we will give the practical results reached.

AN IMPORTATION FROM EUROPE.

This beetle has done great mischief in the Old World, especially in Germany and France, and it is very important that the public know the best method of coping with it here. According to Glover, it was imported as early as 1837. Its distribution was formerly confined to limited areas near the coast, and its earlier attacks were notably about Baltimore and New Jersey.

HABITS AND NATURAL HISTORY.

The general characteristics of this insect have been pretty well studied abroad. Mr. E. Heeger* has given an excellent account of its life-history, with a detailed description of the larva and figures illustrating larva and pupa, and anatomical details. More recently M. Maurice Girard† has given a rather poor wood-cut illustration of the insect and its work, with the leading facts concerning its nomenclature and natural history as observed in Europe. Biological notes on the insect have also been given by Leinweber‡ and Kollar.§

In our country the life-history of the insect and its injury have been referred to by Harris, Fitch, Morris, Walsh, and ourselves, while the agricultural papers contain numerous references to the injury inflicted by the insect. The perfect beetle has often been described in systematic works on Coleoptera.

For these reasons we deem it unnecessary to enter here into a detailed description of the beetle and its earlier stages, but content ourselves with pointing out the more obvious characters, alluding to such facts of the life-history as are necessary to a full understanding of the nature of the remedies to be applied for this pest.

The eggs are deposited in an upright position upon the under side of the leaves (Fig. 3 *a*), always in a group, consisting generally of two, rarely three, more or less irregular rows. The individual eggs are close together in each group (Fig. 2 *e*, magnified,) and so firmly fastened to the leaf that they can only be detached with great care without breaking the thin and brittle shell. The number of eggs in each group varies from four or five to twenty or more. Very rarely only three eggs are seen in one group, but we never found less than that number. The egg itself is oblong, oval, obtusely, but not abruptly, pointed at tip, of straw-yellow color, its surface being opake and beautifully and evenly reticulated, each mesh forming a regular hexagon, as shown, highly magnified, in Fig. 3 *f*. The form of the eggs is not quite constant, some of them, especially those in the middle of a large group, being much narrower than others. The duration of the egg-state is about one week.

The general shape of the larva is very elongate, almost cylindrical, and distinctly tapering posteriorly in the early stages, but less convex, and of nearly equal width when mature. The general color of the young larva is yellowish-black, with the black markings comparatively larger and more conspicuous, and with the hairs arising from

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* Seventieth contribution to the natural history of insects. Sitzungsberichte der kais. Ac. Wiss., Wien, 1858, vol. 29.

† Note sur la Galéruque de l'orme, Bull. d'Insectologie Agricole, VIII, pp. 113–116.

‡ Verhandlungen zoöl.-bot., Ges., Wien, 1856, VI, Sitzb., pp. 74, 75.

§ *Op. cit.*, 1858, VIII, pp. 29, 30.

these markings much longer and stiffer than in the full-grown larva. With each consecutive molt the yellow color becomes more marked, the black markings of less extent and of less intense color, and the hairs much shorter, sparser and lighter in color. A nearly full-grown larva is represented in Fig. 3 *g*, and in this the yellow color occupies a wide dorsal stripe and a lateral stripe each side. The head (excepting the mouth parts and anterior margin of the front), the legs (excepting a ring around the trochanters) and the posterior portion of the anal segment are always black. The first thoracic segment has two large black spots on the disk, of varying extent, and often confluent. The following segments (excepting the anal segment) are dorsally divided by a shallow transverse impression into two halves, and the black markings on these halves are arranged as follows: Two transversal dorsal markings, usually confluent, as shown in our figure; two round and sublateral spots; the tips of the lateral tubercles are also black. The abdominal joints of the ventral surface have each a transverse medial mark, and two round sublateral spots of black color. Stigmata visible as small umbilicate spots between outer sublateral series of dorsal markings and lateral tubercles. The yellow parts of the upper side are opake, but those of the under side shining. The black markings are polished, piliferous, and raised above the remaining portions of the body.

The larvæ are destructive to the foliage from the month of May until August. They have about two weeks of active life between the egg and pupa states. During this time they prey upon the leaves, which become skeletonized, leaving the venation, and commonly a certain portion of the flesh of the leaf, which becomes rust-brown. They undergo four molts, respectively observed at Washington on July 15 (at hatching), 20, 23, and 29 (pupation). When full-grown they descend to the ground and change to pupa under whatever shelter is near to the base of the tree.

The pupa is of brighter color than the larva, oval in shape, and strongly convex dorsally. It is sparsely covered with moderately long but very conspicuous black bristles, irregularly arranged on head and thorax, but in a transverse row on each following segment. The pupa state lasts about from 6–10 days.

The perfect beetle (Fig. 3 *c*, natural size; *k* magnified) resembles somewhat in appearance the well-known striped cucumber-beetle (*Diabrotica vittata*), but is at once distinguished by the elytra not being striate punctate but simply rugose, the sculpture under high magnifying being represented in Fig. 3 *l*. The color of the upper side is pale-yellow or yellowish-brown, with the following parts black: on the head a frontal (often wanting) and a vertical spot; three spots on the thorax; on the elytra a narrow stripe along the suture, a short, often indistinct scutellar stria each side, and a wider humeral stripe not reaching the tip. Under side black, pro- and mesosternum and legs yellow, femora with a black apical spot. Upper and under side covered with very fine, short, silky hairs. In newly-hatched individuals the black markings have a greenish tint; the humeral stripe varies in extent.

The beetle assists the larva in its destructive work, but, as usual in such cases, the damage done by the perfect insect is small when compared with that done by the larva. There are three or four annual generations of the insect, according to the character of the season. In the month of September the beetles prepare for hibernation, seeking shelter in hollow trees, in the ground, under old leaves, &c., and remain dormant until the following spring.

REMEDIES.

M. Girard says:

There is no other means of destruction than to jar the branches over cloths to collect the larvæ and adults which fall. It is also possible when they are on the ground to distribute on them boiling water or steam, or even quick-lime or solution of sulphocarbonate of potassium.

In our own country much more has been accomplished toward practically combating this insect.

In the U. S. Agricultural Report of 1867, Glover suggested the use of

oil and tar gutters and other barriers surrounding the base or the body of the tree, devices similar to those used against the canker-worm and codling-moth. He then and afterward (1870) recommended "to place around each tree small, tight, square boxes or frames, a foot or 18 inches in height, sunk in the earth; the ground within the inclosure to be covered with cement, and the top edge of each frame to be covered with broad, projecting pieces of tin like the eaves of a house or the letter T, or painted with some adhesive or repellant substance, as tar, &c. The larvæ descending the tree, being unable to climb over the inclosure, would change into helpless pupæ within the box, where they could daily be destroyed by thousands. Those hiding within the crevices of the bark of the trunk could easily be syringed from their hiding places." (U. S. Agricultural Report, 1870, pp. 73, 74.) These boxes were carefully tested at this Department, and they worked as described. While coal-tar and other adhesives were recommended, we have found scalding-hot water most convenient for destroying the insects that accumulate in the inclosure or upon the ground elsewhere. Where branches are low and droop near the ground some of the larvæ descend the wrong way and fall off, but shade trees should not be allowed to grow in this low, drooping manner, and under all ordinary circumstances, where the branches are not severely jarred to encourage the insects to drop, the larvæ will descend by the trunk and become captured in the devices here noticed.

Mr. Glover regarded the pupa state as the most favorable in which to kill the insect, as it can then be easily crushed or scalded. Concerning the tobacco treatment he adds that "syringing the trees with strong tobacco water has been tried with some good effect, but the larvæ not touched by the fluid are merely knocked down by the concussion, and, if nearly ready to change into pupæ, effect their transformation where they fall."

In this connection we cannot do better than quote what we published in 1880* in reply to certain statements by Dr. J. L. Le Conte, as follows:

Anent *Galeruca xanthomelæna*, which is becoming more destructive each successive year to the shade elms in our northern towns, a correspondent mentions the following facts:

1. The trees are not all attacked at the same time, but the insect seems to break out from a center, gradually destroying the more remote trees, so that isolated trees remain comparatively free.

2. After applying a band (saturated with fish-oil, petroleum, &c.) to some trees which were about half denuded, found hundreds of the worms stopped both in ascending and descending the trees.

He also propounded the following query:

3. Do the beetles hibernate in the ground, so that they can be poisoned, or are they perpetuated only by the eggs on the trees?

Allow me to add the following subjects for investigation as necessary to the devising of proper remedies against this foreign invader:

4. How soon do the insects appear in the spring; how rapidly do they propagate; and what time is passed in each stage of development?

5. Are the larvæ and beetles eaten by insectivorous birds, or are they protected by offensive secretions, as is the case with *Doryphora 10-lineata, Orgyia leucostigma,* and several other noxious insects?

6. What proportion of the brood hibernates, and in what stage, pupa or perfect insect, and where?

If the materials for furnishing answers to these questions are not yet within your reach, will you kindly direct the attention of some of your trusty observers to the subject, so that persons interested in the preservation of the shade trees which are so justly esteemed may be properly instructed as to the measures to be adopted during the next summer.

Very truly, yours,
J. L. LE CONTE,
Philadelphia, Pa.

**American Entomologist,* December, 1880, p. 291.

The above inquiries were received from our esteemed correspondent some time since, and we employ them as a ready means of giving our experience with the beetle.

For the benefit of the general reader it may be remarked that the natural history of this Elm Leaf-beetle is quite similar to that of the well-known Colorado Potato-beetle and of the Grape-vine Flea-beetle. The only deviation in the Elm Leaf-beetle is in the mode of pupation, which rarely takes place in the ground, unless this be very friable, but at the base of the tree or under any shelter that may present itself near the trees, such as old leaves, grass, &c.

(1.) The phenomenon here described is doubtless due to the gradual increase in spring from one or more females.

(3 and 6.) Like most, if not all, *Chrysomelidæ*, the Elm Leaf-bettle hibernates in the perfect state. As places suitable for hibernation abound, any attempt to successfully fight this pest in winter time, with a view of preventing its ravages the subsequent season, will prove fruitless. A large proportion of the hibernating beetles doubtless perish, since the insect is comparatively scarce in the earlier part of the season.

(4 and 5.) The beetles fly as soon as spring opens, and we have observed the first larvæ early in May, in Washington, D. C., or some time after the elm leaves are fully developed. The ravages of the insect begin to be apparent with the second generation of larvæ, which appear in June.

In 1878 we made many notes and experiments on the species, and the development of the third and most injurious generation occupied about one month. The numerous pupæ, which in the latter part of August were to be found under the trees, were mostly destroyed that year, partly by continuous wet weather prevailing at the time, partly by the many enemies of the insect. Among these there are *Platynus punctiformis* and *Quedius molochinus*, which feed on the full-grown larvæ when these retire for pupation, and also on the pupæ. The larva of a *Chrysopa* (probably *C. rufilabris*) feeds upon the eggs of the *Galeruca*; *Reduvius novenarius* sucks both beetles and larvæ on the leaves, while *Mantis carolina* preys upon the beetle. Of the numerous other insects found among the pupæ under the trees, *e. g. Tachyporus jocosus*, sundry spiders, myriapods, &c., several are doubtless enemies of the *Galeruca*, though we have, as yet, no proof of the fact. Many birds were observed on the trees infested by the beetles, but the English Sparrow, which was the most numerous, did not feed on the insect in any stage of growth.

The only method of warfare against this pest recommended by European writers is to jar the larvæ down on to sheets, and then in one way or another to destroy them. This may answer for young trees, but is then tedious and but partial. We found that the quickest and most satisfactory way of destroying the insect and protecting the trees was by the use of Paris green and water in the manner frequently recommended in these columns, and London purple will evidently prove just as effectual and cheaper. The syringing cannot be done from the ground except on very young trees, though a good fountain pump will throw a spray nearly 30 feet high. Larger trees will have to be ascended by means of a ladder and the liquid sprinkled or atomized through one of the portable atomizers, like Peck's, which is fastened to the body, and contains 3 gallons of the liquid.

The mode of pupation of the insect under the tree, on the surface of the ground, beneath whatever shelter it can find, or in the crevices between the earth and the trunk, enables us to kill vast numbers of the pupæ and transforming larvæ by pouring hot water over them. We found that even Paris green water poured over them also killed. If the trees stand on the sidewalk of the streets the larvæ will go for pupation in the cracks between the bricks or at the base of the tree, where they can also be killed in the same way. This mode of destruction is, take it all in all, the next most satisfactory one we know of, though it must be frequently repeated.

(2.) We have largely experimented with a view of intercepting and destroying the larvæ in their descent from the tree. Troughs, such as are used for canker-worms, tarred paper, felt bands saturated with oil, are all good and the means of destroying large numbers. Care must be taken, however, that the oil does not come in contact with the trees, as it will soon kill them, and when felt bandages are used there should be a strip of tin or zinc beneath them. The trouble with all these intercepting devices, however, is that many larvæ let themselves drop down direct from the tree and thus escape destruction.

In conclusion we would remark that it is highly probable that Pyrethrum powder stirred up in water might be successfully substituted for arsenical poisons, but experiments in this direction have not yet been made. From experiments we have made with dry, unmixed powder, we found that it affects very quickly the larva, pupa, and the perfect insect, but in order to be applied on a large scale and on large trees the powder must of course be mixed in water. There is, however, no danger in the judicious use of the arsenical liquids upon shade trees.

MORE RECENT EXPERIENCE AT THE DEPARTMENT.

The more recent experience in the destruction of this Galeruca on the Department grounds may now be summed up, the experiments having been intrusted to Dr. Barnard.

Past history of the Elms in question.—According to Mr. William Saunders, of this Department, these trees have been annually attacked by the European Elm Leaf-beetle since they were planted ten years ago, and about one year in three the injury has been severe, resulting in their defoliation, while in other years, as in 1879 and 1880, there appeared comparatively none. In some seasons a second or autumnal set of leaves appeared after the trees had been stripped, and in certain of these instances the second crop of leaves became eaten; but in all cases he thinks the lives of the trees have not seemed to be endangered and they soon repaired the damage done. His belief is also that the pest did not become gradually worse and worse through the series of years during which it has been observed by him, still he regards the attack of 1882 as worse than any known to him before on these trees or others, and he has noticed the effects of this insect since 1850, first in its earliest ravages about Baltimore, and later elsewhere.

Condition and Characteristics of the Grove in 1882 *and* 1883.—However it may be for the past history or future desirability of certain trees in the grove, in 1882 many exhibited various grades of feebleness, and some had dying branches. Indeed, a few of them had a very unhealthy aspect the previous year also. Of course it can be claimed that their unhealthy condition is due to other causes than the insects; and it should be remembered that most are foreign species, each often represented in two or more of its varieties. Here all grow on level ground, whereas in a state of nature some belong to mountainous localities; others to the damp climate of England, &c. Therefore, many of them are growing under abnormal conditions. They exhibit much variety in the relative abundance, size, form, and texture of the leaves. There is also great diversity in the density and form of branching.

Extent of injury in 1882 *and* 1883.—All the varieties and species of elms in this grove, without exception, were preyed upon by the pest in 1882 and 1883. The insect, however, showed decided preferences for certain individual trees, varieties, or species, stripping some completely before doing more than very slight harm to the leaves of others, the former becoming completely eaten in midsummer, the latter not until toward the close of the season, or remaining only slightly damaged until then. In 1882 the leaves were eaten faster than they could be developed, and the insect continued abundant enough to prevent a second crop of foliage until in November, when it became too cold for the leaves and active insects to exist.

On these grounds the southeast side of each tree has suffered more than the northwest half. This peculiarity has been very strongly pronounced this year, 1883, on all the trees affected, and upon some examples far more markedly than upon others. This one-sidedness is especially apparent in the trees which were the most severely eaten. Some trees show the southeast side completely devoured but the northwest side only half consumed and comparatively green. Such are average cases.

The inferences have been, that the shade, dampness, and coolness of the tree on the northwest side during the morning is too unhealthy for the favorable development of the larvæ or of the eggs deposited there; but whether this be true or not, the insect probably prefers to deposit

chiefly in the middle of the forenoon, and on that part of the tree which is then warmest. This would give a greater number of the eggs at the outset on the southeast side, as observation seems to confirm, and since the young larvæ do not migrate to any noteworthy extent, the one-sidedness described would result, whether the northwest side were unhealthy or not. The former explanation is most probably the correct one, as we have noticed that the insect is less injurious during very wet summers.

Preferences of the Elm beetles for certain Varieties and Species of Elms.—The American slippery elm does not occur in this grove, but only one native species, the common American elm, *Ulmus americana*. This is practically free from the ravages of the beetle, on which account it may be preferred to the European species. It is tall, and has gracefully arched branches, making it as ornamental as any European kind, yet as a shade tree it does not equal the *U. montana* of the Old World. The latter has a broader, denser crown, but the attack on it is considerable, enough to leave the choice in favor of the American species.

U. montana seems the best European species grown here for shade, since the other foreign elms here cultivated are not dense enough. This applies to *U. campestris*, *U. suberosa*, *U. effusa*, and *U. parvifolia* (*siberica*). The last named is not attacked as much as the American. The young larvæ cannot develop on it, but die quite soon, without growing, and they gnaw the leaves very little. The other foreign species mentioned are seriously eaten; the severest attack being upon the *U. campestris*, the favorite food of this insect.

As early as June 25, in 1883, this species was completely eaten and brown in our grove, at which date the *U. montana* examples retained more than half their verdure; in some individuals nearly all; and the common American elm was perfectly green. The *U. campestris* is one of the poorest elms for shade, and its total abolishment throughout the entire country would probably lessen the assault on *U. montana* to a comparatively unobjectionable extent. This measure should be instituted against the pest, and for the sake of the other species of elms.

Effects of arsenical Poisons on Insect and Plant.—Species of elms are somewhat differently affected by the poison. When treated alike there is always manifest some difference in the susceptibility of different elms to the corrosive effects of the poison. Even individuals of the same species or variety are differently impaired. As a rule, those which suit the insect best are injured most by the poison, and those which resist the insect most withstand the poison best. The latter have coarser foliage with darker green color and more vigorous general growth; the former have more delicate foliage, lighter in color and weight, apparently less succulent.

Certain elms of the species *U. campestris* and other species which were overpoisoned, and shed most of their leaves in consequence in the last of June, 1883, sent out a profuse new growth of leaves and twigs. The foliage fell gradually for three weeks and this was somewhat promoted by the succeeding rains.

The larvæ move from place to place so seldom that if the leaves are imperfectly poisoned from the mixture being weakly diluted, or from its application only in large, scattered drops, which are much avoided by the larvæ, they are not killed off thoroughly for several days, and in all cases it requires considerable time to attain the full effect of the poison. This result appears on the plant and on the insect. After each rain the poison takes a new effect upon the plant and the pest, which indicates that the poison is absorbed more or is more active when wet, and that it acts by dehydrating thereafter. Where the tree is too strongly poi-

soned, each rain causes a new lot of leaves to become discolored by the poison or to fall. On some of the trees the discoloration appears in brown, dead blotches on the foliage, chiefly about the gnawed places and margins, while in other instances many of the leaves turn yellow, and others fall without change of color. The latter may not all drop from the effects of poison, but the coloration referred to is without doubt generally from the caustic action. The poison not only produces the local effects from contact action on the parts touched by it, but following this there appears a more general effect, manifest in that all the foliage appears to lose, to some extent, its freshness and vitality. This secondary influence is probably from poisoning of the sap in a moderate degree. When this is once observable, no leaf-eater thrives upon the foliage. Slight overpoisoning seems to have a tonic or invigorating effect on the tree.

Preventive Effects of the Poison.—In this grove the elms that were poisoned in 1882 were attacked in the spring of 1883 less severely than were those which were not poisoned the previous year. This would seem to imply that the insects deposit mostly on the trees nearest to where they develop, and are only partially migratory before ovipositing. The attack afterward became increased, probably by immigration and the new generation, so that later in the season the trees were mostly infested to the usual extent.

In the region of Washington *a preventive application of poison should be made* before the last of May or first of June, when the eggs are being deposited and before they hatch. This will prevent the worms from ever getting a start. By the preventive method the tree escapes two kinds of injury; first, that directly from the eating by the insect; second, that which follows indirectly from the deleterious effects of the poison on the plant, for its caustic effect is much greater where the leaves have been so gnawed that the poison comes in contact with the sap.

Treatment with London purple.—Already early in June the insect appears plentiful. On June 7, 1882, it was at work on all the trees, and its clusters of eggs were numerous beneath the leaves. Some of the trees had half of the leaves considerably gnawed and perforated by larvæ of all sizes, and by the adults. At this date fifteen trees, constituting the south part of the grove, were treated.

Preparation of the Poison.—London purple (one-half pound), flour (3 quarts) and water (barrel, 40 gallons) were mixed, as follows: A large galvanized iron funnel of thirteen quarts capacity, and having a cross-septum of fine wire gauze such as is used for sieves, also having vertical sides, and a rim to keep it from rocking on the barrel, was used. About three quarts of cheap flour were placed in the funnel and washed through the wire gauze by water poured in. The flour in passing through is finely divided, and will diffuse in the water without appearing in lumps. The flour is a suitable medium to make the poison adhesive. The London purple is then placed upon the gauze and washed in by the remainder of the water, until the barrel is filled. In other tests, the flour was mixed dry with the poison powder, and both were afterward washed through together with good results. It is thought that by mixing in this way less flour will suffice. Three-eighths of a pound of London purple to one barrel of water may be taken as a suitable percentage. Three-eighths of an ounce may be used as an equivalent in one bucketful of water. The amount of this poison was reduced to one-fourth of a pound to the barrel with good effect, but this seems to be the minimum quantity, and to be of value it must be applied in favorable weather and with unusual thoroughness. With one-half or three-

fourths of a pound to the barrel, about the maximum strength allowable is attained, and this should be applied only as an extremely fine mist, without drenching the foliage.

Effects of the Mixture.—The flour seems to keep the poison from taking effect on the leaf, preventing to some extent the corrosive injury which otherwise obtains when the poison is coarsely sprinkled or too strong. It also renders the poison more permanent. On the leaves, especially on the under surfaces, the London purple and flour can be seen for several weeks after it has been applied, and the insect is not only destroyed, but is prevented from reappearing, at least for a long period. By poisoning again, a few weeks later, the insect is deterred with greater certainty for the entire season. By being careful to administer the poison before the insect has worked, and, above all, to diffuse the spray finely but not in large drops, no harm worth mentioning will accrue to the plant from the proportion of poison recommended. The new growth, that developed after the first poisoning, was protected by one-fourth of a pound to the barrel in 1882. From midsummer until autumn the unpoisoned half of the grove remained denuded of foliage, while the poisoned half retained its verdure. The little damage then appearing in the protected part was mostly done before the first treatment. Eggs were laid abundantly throughout the season. Many of these seemed unhealthy and failed to develop, probably because they were poisoned. Many hatched, but the young larvæ soon died. The eggs were seldom deposited on the young leaves that were appearing after the poison was applied, but were attached to the developed leaves, and here the larvæ generally got the poison to prevent their attack upon the aftergrowth. Still the young leaves became perforated to some extent. The adults, which fly from tree to tree, appeared plentiful without much interruption throughout the season, and often several could be seen feeding on each tree. Possibly many of these may have become poisoned before depositing the eggs.

The efficiency of London purple being established, it will generally be preferred to other arsenicals, because of its cheapness, better diffusibility, visibility on the foliage, &c. As the effects of the poisons commonly do not appear decidedly for two or three days after their administration, the importance of the preventive method of poisoning in advance cannot be too strongly urged. As the effect is slow in appearing, impatient parties will be apt to repoison on the second or third day, and thus put on enough to hurt the plant when the effect does come. Much depends on dryness or wetness of the weather; but good effects may be expected by the third or fourth day.

London purple seems to injure the plant less than Paris green.

Treatment with Paris green.—In 1883 the Paris green was first applied on the 29th of May, at which date the eggs were extremely abundant and hatching rapidly on the leaves. Paris green, flour, and water were mixed by the means previously employed with London purple and already described. The mixture was applied to the north part of the same grove of elms. Thus far experience shows that the Paris green is effective against the insect, but that this poison injures the plant more than does the London purple.

Three-fourths of a pound of Paris green to a barrel (36 or 40 gallons) of water, with 3 quarts of flour, may be regarded as a poison mixture of medium or average strength for treating elms against these beetles, and the indications thus far are that the amount of Paris green should not be increased above one pound or be diminished much below one-half a pound in this mixture. To a bucketful of water three-fourths of

an ounce of Paris green may be used. The action of this poison is slow but severe, and varies much with the weather. Thus far the results of tests have been varied so much by the weather and different modes of preparation and application that they will be repeated. When used strong enough to cauterize the leaves the poisonous action upon the plant may be observed to continue for several weeks.

Mechanical Means of applying the Poison.—When many trees were to be sprayed a cart or wagon was employed to haul the poison in a large barrel provided with a stirrer, force-pump, skid, &c. The following brief account of the skid, mixer, barrel, and pump may be reproduced here from our last Annual Report:

The skid is a simple frame to hold the horizontal barrel from rolling, and consists of two pieces (Plate VI, Fig. 1 *a a*) of wood, about the length of the barrel, and in section about 3 by 4 inches, joined parallel, apart from each other, by two cleats, *b b*. The inner upper angles may be cut to match the curve of the barrel, as at *c c*. The barrel being placed upon this frame is next to be filled.

A good device for mixing the poison thoroughly with the water and for filling the barrel is shown in section in Plate VI, Fig. 4. It consists of a large funnel that will hold a bucketful, and has cylindrical sides, *g g*, that rest conformant on the barrel. In this is a guaze or finely-perforated diaphragm, or septum, *d*, and a funnel base, *jj*, with its spout, *p*, inserted through the bung.

By reference to Plate VI, Fig. 4, the barrel, *k*, will be seen in section, and some of its details, together with those of the pump and stirrer, may be noticed. The fulcrum, *f*, has a foot below, screwed to the barrel. Through its top is a pivot, *o*, on which tilts the pump-lever, *l*, which is similarly hinged at *b* to the top of the piston-rod, *t*. The pump-cylinder, *g*, is also hung upon trunnions, *i*, projecting into eyes. In this illustration the eyes, *e e*, have each a neck fitting in a slot cut through the stave, oppositely from the side of the bung-hole, and beneath the stave is a foot on the eye-piece. Its neck is so short that the eye is held down firmly against the top of the stave, while the foot is as tight against its under surface. The length of its eye-piece is a little less than the diameter of the bung-hole, into which it may be inserted to be driven latterly into the slot. The slot is longer than the eye-piece, so the latter may be driven away from the bung-hole for a distance greater than the length of the trunnion pivot. Then the pump being inserted, until these pivots come opposite the eyes, the latter may be driven back as sockets over the pivots, which play in them when the pump is worked. To hold these eyes toward the pump and upon the trunnions a wedge, *v*, is driven in the slot beyond each eye-piece. Thus the pump is easily attached or removed, and its union with the barrel is strong and firm. Perchance it be desired that this pump-hole be bunged, the side slots may be wedged to make the barrel tight.

The parts of the pump being hung as described, the hinge, *b*, forms a toggle-joint, and in its action causes the pump to oscillate on its trunnions, its basal end swinging wider than its top, as indicated by the dotted line from *x* to *y*. Upon the extremity of this swinging end is a loop, *h*, through which is passed a stirrer-bar, *m n*, made to sweep back and forth in the lower side of the barrel, thus to agitate and mix the substances considerably during the operation of the pump, every stroke of the handle causing one or two strokes of the stirrer.

The method of inserting and extricating the stirrer-bar is as follows: It is raised with the pump until the end, *m*, comes opposite the bung-hole, *x*, through which the bar may be pulled out by the cord, *w*, which is attached to the end, *n*, and also preferably to the bungs, *r* and *z*, as shown. Through the same hole the bar may be inserted. This stirring device is the simplest in construction and operation of any yet contrived, while working as it does with reference to the concavity of the barrel it is perfectly effective.

The pump is double-acting and very powerful, giving strong pressure to disperse the liquid far and finely, for, with the eddy-chamber nozzle used, the greater the pressure the finer is the liquid atomized. A block or other catch may be fixed on the side of the barrel to fit against the skid and prevent the barrel from rocking therein, as might otherwise happen when it is nearly empty if much power is applied. About one pailful of poisoned water was sprayed upon each tree. When only two or three trees were to be treated an aquapult or other bucket-pump was used to force the poison from a bucket carried by hand. The Paris-green mixture needs to be almost constantly stirred, as this poison pre-

cipitates quickly; but with London purple the agitation is only occasionally necessary.

Connected with either pump is a long, flexible pipe, with its distal part stiff, and serving as a long handle whereby to hold its terminal nozzle beneath the branches or very high up at a comfortable distance from the person managing it. Parts of one form of this extension pipe are shown in Figs. 1 and 2.

To the pump spout is attached the long, 2-ply, flexile hose, *h h*, of ¼-inch caliber. Its considerable length, 12 feet or more, allows the nozzle to be carried about the tree without moving the pump. Beyond its flexile part the hose, *h*, passes through a bamboo pole, *b*, from which the septa have been burned out by a hot iron rod. At the distal end of the pole the hose terminates in a nozzle, *n* or *m*. When the nozzle is in its natural position, *m*, the spray, *z*, is thrown straight ahead, and this suits well for spraying very high branches, but for spraying the under surfaces of the lower parts of the tree it is necessary that the nozzle discharge laterally from the pipe, and this is accomplished with a nozzle having a direct discharge by bending it to one side. The nozzle, *n*, and spray, *s*, are directed laterally, and the nozzle, *n*, is maintained in this position by a metallic hook or eye, *v*, having a crooked stem inserted at the side of the hose in the end of the pole. Where the side spray is permanently desired, the metallic stem is inserted inside the hose and connected with the base of the nozzle, or the tubular stem of the nozzle is given the desired crook. For small trees the simpler extension pipe shown in Fig. 2 is satisfactory. The metallic tube, *t*, several feet in length, is used as the stiff part, *t*, connected with the hose, *h*. One longer metallic pipe, having telescopic sections made tight by outside segments of rubber tubing, has also been employed, and is a very desirable extension pipe. Where only low end-spraying is to be done, as upon small trees, &c., the eddy-chamber nozzle is set upon such a pipe, or upon its own stem, so as to discharge at right angles therefrom; but a diagonal position of the chamber, *n*, on its stem, *i*, throws the spray, *s*, at an intermediate angle between the right angle and a direct line, by which, without any readjustment, the spray, *s*, can be directed high or lower, beneath the foliage or above. For general use, this kind of nozzle is the best. With ordinary force-pump pressure the discharge-hole of the nozzle is about one-sixteenth of an inch in diameter for misty sprays with particles invisibly small. Rather than use the larger, coarser sprays, which were usually employed in these tests, it is better to use the finest spray. The spray falling upon the extension pipe soon accumulates enough to flow down the pole and wet the hands. To prevent this a wrapping washer of leather or other flange may surround the pole proximally from the spray, and the drip will drop off from its margin. Such an arrangement is indicated at J in Plate VI, Fig. 1.

While one person operates the pump, another, standing in the vehicle or upon the ground, directs the spray by the stiff part of the pipe. Thus the operator cannot only spray higher and lower with convenience, but he can, to a great extent, move the spray from place to place without leaving his own position and without moving the vessel of poison with the pump.

The hose and bamboo combination was conceived of, and used as the lightest, long, stiff tube practicable for these purposes, and it has answered admirably. A similar pole, with a metallic tube in its interior, with a nozzle not producing the very fine mist desired, and lacking the side discharge, &c., was afterward learned of as being used in California. (See Agricultural Department Report, 1881–'82, p. 208.)

By the apparatus used, when everything is prepared, a tree can be sprayed quickly, and a large grove is treated in a short time. It is equally adapted for forestry use in general, and likewise available for poisoning on fruit trees, when not in fruit, while the shorter style of extension-pipe is convenient for underspraying all kinds of low plants.

THE LESSER MIGRATORY LOCUST.

(*Caloptenus atlanis* Riley.)

Order ORTHOPTERA; family ACRIDIDÆ.

[Plate II.]

ITS RAVAGES IN THE MERRIMAC VALLEY, NEW HAMPSHIRE.

The ravages of this insect (which is the Eastern prototype of the Rocky Mountain locust) in certain parts of New England during the summers of 1882 and 1883 have induced us to devote some space to it in this report with a view of laying the chief facts before the farmers who have suffered from it and of indicating what can be accomplished in practically dealing with it. For this purpose we shall repeat much that was said on the subject in the first Report of the United States Entomological Commission, in which the species is discussed incidentally, and which has been for some time out of print and not to be obtained for distribution. The greatest injury seems always to have been done in the Merrimac Valley, New Hampshire, and there are many interesting circumstances connected with the history and work of the species in said valley. These we are yet studying and hope before long, when all the facts have been ascertained, to present them connectedly, in the hope that some useful conclusions may be arrived at. In the meantime this summary of what is now known will, we hope, prove useful.

HISTORICAL.

We know that migratory locusts do commit sad havoc in the Eastern States from time to time, and are so effectual in their work of destruction that many persons are led to suppose that the Rocky Mountain species has suddenly found its way among them. Among the earlier accounts of the flights and ravages of migratory locusts in this section of country, we find in Harris's Treatise on Injurious Insects an extract from the travels of President Dwight, wherein "they are recorded as being most destructive in Vermont in 1797 and 1798, and as collecting in clouds, rising in the air and taking extensive flights—even covering persons employed in raising a church steeple, who, in such position, saw the insects flying far above their heads." He also quotes from Williamson's History of Maine, that, in 1749 and 1754, they were very numerous and voracious; that "in 1743 and 1756, they covered the whole country and threatened to devour everything green." In 1816 they are said to have made their first appearance in the Merrimac Valley, New Hampshire, or at least this is the first appearance of which there is authentic record.

In 1821 the locusts did great damage in Cumberland County, Maine, and we have elsewhere given (*loc. cit.*) a detailed account of the visitation.

In 1826 such ruin to the crops was occasioned by the locusts in Boscawen, N. H., that a day of fasting and prayer was appointed by the

church authorities. Concerning more recent years, we quote the following newspaper paragraphs, which evidently refer to this species:

Grasshoppers are reported to have very seriously injured the corn, grass, and grain crops (and in some cases orchards and nurseries) of the counties of Androscoggin, Franklin, Knox, Kennebec, Lincoln, Oxford, Piscataquis, Penobscot, Waldo, and Somerset, in Maine. So serious has been the damage that the subject was made a topic at the recent State agricultural convention in that State. In Androscoggin County they injured pastures greatly, and affected the condition and price of stock. Some grain fields were protected by drawing a rope across the heads at sunset, thus brushing off the insects and preventing feeding.

In Franklin County a field of 12 acres of sweet corn was only saved by keeping a man in it continually to drive out the grasshoppers. One man in York County stopped their passage to his fields by building a brush-fence around them.—[*American Agriculturist*, 1871.

These pests (the locusts) have been numerous and destructive during the past month in some portions of the Eastern States. In Sagadahoc County, Maine, the crops and pastures were injured by them very much; also in Hancock County. In Franklin many fields of grain were cut to save the crops from them and for feeding. In Oxford oats were "eaten entirely down, as clean as though fed upon by sheep." In some portions of Plymouth County, Massachusetts, they are reported to have eaten everything green. In Caledonia County, Vermont, they have been very destructive. All through Windsor they have been "a terrible scourge." In Orleans they are reported abundant, and in Windham they have done "much injury to some of the crops." In Wayne County, Pennsylvania, also, they are reported to have done much damage.—[*Monthly Report, Department of Agriculture*, for August and September, 1871.

In 1872 locusts were again bad in the Eastern States, as will appear by the following from the *Mirror and Farmer* (New Hampshire) for August 10:

The grasshoppers are making great havoc on the grass, grain, and corn. For a space of about one and a half miles square they are destroying almost everything. Clover is trimmed up all but the head; oat-fields look like fields of rushes coming up to the height of 16 or 18 inches without leaf or head. The leaves of wheat and their kernels are eaten out. These choppers move back and forth two or three times a day, and whole sections are almost alive with them.

The year 1874 was a marked one in the Merrimac Valley. They destroyed the hay crop and most of the garden vegetables.

In 1875 they were reported very injurious in Massachusetts, as the following items will show:

Grasshoppers in Boston.—We did not anticipate that Boston proper would ever be so inconvenienced by the pests which have proved so destructive out West, but it is a fact that grasshoppers are so numerous at the South End that they destroy the flowers in the back yards to such an extent that hens are hired or bought to clear the premises and save the ornamental plants which adorn the premises. These insects are not of the western pattern, but are native productions. If their ravages continue, it is possible some of our Western friends will be called upon to raise subscriptions for the relief of the floriculturists of Boston.—[*Boston Journal.*

I venture to ask your advice in a grasshopper matter. Three years ago a party of farmers and others in this commonwealth, tired of granite hills, gravel banks, and sand flats, and wishing some little latent fertility in the original soil, combined to effect, and did effect, the reclamation from the sea of about 1,400 acres of what originally was "salt marsh." We are amply satisfied of the fertility of this land, and, so far, all is good. Last summer, however, this land and the adjoining territory was scourged with a plague of locusts or grasshoppers. Whether they came in such numbers owing to the diking of these 1,400 acres, or whether they would, last year, have come in equal numbers whether the marsh was diked or not, we cannot say.

Our question is this, and is at the same time the point upon which we pray your advice: Can we do anything to diminish the number of these pests for next year? We could, for example, flood this whole tract of tract of land until early spring. Would this be advisable?

Any points you would be kind enough to give us on the matter would be thankfully received.—[Letter from C. Herschel, Boston, Mass., latter part of October.

1877.—In North Hero, grasshoppers are doing much injury to beans, oats, and buckwheat.—[*Mirror and Farmer*, Manchester, N. H., August 11, 1877.

We are informed by a farmer, resident in Northern New York, that the grasshoppers have committed irreparable injury to the growing crops in that section, thus

blighting the prospects of a bountiful harvest. They attacked first the grass, and when that was cut, they assailed the oats and orchards, utterly ruining them, and are now rapidly destroying the corn and potatoes. There is no barrier to their ravages, and the only hope is in their onward progress. This gentleman thinks that this plague will reach New Hampshire by another year, as it has already appeared in Vermont. The only precaution that can be taken is in the character of the crops, and unfortunately there are few crops they do not assail.

Thus far, the growing wheat in Northern New York has been exempt from their ravages.—[*Nashua Telegraph*.

We have seen in the valley of the Merrimac this summer fields in which the grasshoppers had cut the grass as clean and close as a flock of sheep would have done, and fields of beans and oats in which every leaf had been devoured.—[*Mirror and Farmer*, August 18, 1877.

According to the statements of the farmers of the Merrimac Valley, the permanent occupation of this valley by the locusts seems to date from 1873. In 1874 they appeared in force throughout the valley, from Concord to Franklin. From July to October of that year, on certain farms, notably that of Mr. J. K. Chandler, absolutely no green thing was to be seen, and the land was in the condition of a burnt prairie, even the bark of the trees and the paint from the barns and fences being eaten. In 1875 they appeared in force in that part of the valley known as the "Webster Place," and in 1876 appeared in parts of the valley hitherto unmolested. Since 1876 they are said to have pervaded the entire region, sometimes more in one locality than in others, but always in sufficient force to seriously injure the crops.

In the portion of the valley actually infested, the residents estimate the annual loss to be from one-third to one-half the crop of grass, grain, and vegetables. On certain farms it is stated that not a single bushel of small grain has been threshed for eight years.

In 1882 the locusts were present in enormous numbers, and an appeal was made to the Department in July. We have since then visited the locality several times in person and have upon two occasions sent assistants there. Upon June 4, 1883, we met by appointment, at the farm of Mr. J. K. Chandler, a number of the prominent farmers of the vicinity, in order to demonstrate the efficacy of some of the most practical of the remedies used against other locusts having precisely similar habits. The results of the investigation and experiments have been very satisfactory, and a spirit of renewed hopefulness and energy is replacing the despair which before prevailed.

CHARACTERS.

The species *Caloptenus atlanis* was always confounded with the common red-legged locust of the east (*C. femur-rubrum* DeG.) until we characterized it as a distinct species in our Seventh Missouri Report, p. 169 (1875), to which and to the first report of the Commission already cited, we refer the reader, who is interested in the nicer questions of classification, and who wishes to study the many differences which always distinguish the Rocky Mountain locust (*spretus*), the common non-migratory red-legged locust (*femur-rubrum*) and the lesser migratory species (*atlanis*). The distinguishing characters of this last as then published are as follows:

Caloptenus atlanis, adult.—Length to tip of abdomen 0.70–0.85 inch; to tip of closed wings, 0.92–1.05 inches. At once distinguished from *femur-rubrum* by the notched character of the anal abdominal joint in the male, and by the shorter, less tapering cerci; also by the greater relative length of wings, which extend, on an average, nearly one-third their length beyond the tip of the abdomen in the dried specimens; also by the larger and more distinct spots on the wings—in all which characters it much more closely resembles *spretus* than *femur-rubrum*. From *spretus*, again, it is at

once distinguished by the smaller size, the more distinct separation of the dark mark running from the eyes on the prothorax and of the pale line from base of wings to hind thigh; also by the anal joint in the ♂ tapering more suddenly and by the two lobes forming the notch being less marked. From both species it is distinguished not only by its smaller size but by the deeper, more livid color of the dark parts, and the paler yellow of the light parts—the colors thus more strongly contrasting. (See Plate II, Figs. 6, 7, 9, and 10.)

Immature states.—Aside from its smaller size, throughout its growth, this species may be distinguished as follows: In the first stage it is more uniformly and distinctly dotted with black, the legs being strongly dotted and banded, and the hind thighs being darker and showing much more distinctly the pale transverse streaks. In the second stage the color is more livid or rosy, with a more strongly contrasting yellow venter. In the subsequent stages, these colorational differences still prevail, and the face is not black as in *spretus;* the pale spot on the hind wing-pads is less conspicuous in the fourth stage, and the pupa is distinguished, not only by its smaller size and different color, but by the narrower, more obsolete black marks of the prothorax and by the wing-pads being considerably shorter and smaller, the hind pair livid, with only rarely a touch of black at base, and with the pale spot sub-obsolete. The pale streaks on the outside of the hind thighs are always conspicuous. It presents, in fact, a marked contrast to the pupa of *spretus. Atlanis* invariably has a pale face—yellow or greenish, speckled with gray-brown; and, just as invariably, the outside of the hind thighs more mottled, with pale oblique streaks through the black. (See Plate II, Figs. 1, 2, 3, 4, and 5.)

RANGE AND LIFE HISTORY.

Unlike the Rocky Mountain locust, the permanent breeding grounds of which are limited to but a portion of the vast territory which it occasionally overruns and ravages, *C. atlanis*, in common with *C. femur-rubrum*, has a very extended natural range, breeding annually in abundance from Middle Florida to the sub-boreal portions of Canada. Our experience of the past five years during which we have visited and examined the locust fauna in many sections along the Atlantic from Quebec to Northern Florida, would indicate that it is much more prevalent than *femur-rubrum* and is, in fact, the common social and migratory species of the East. In many parts it entirely replaces *femur-rubrum*, and we have been astonished to find that of the thousands of specimens examined in Massachusetts and New Hampshire during 1882 and 1883 all, without exception, have been *atlanis*. As we approach the Mississippi this condition of things is changed, and *femur-rubrum* generally predominates, and in some localities entirely replaces *atlanis;* while in the great plains west of the Mississippi both are supplanted by *spretus. Atlanis*, with several closely allied forms, reappears again toward the Pacific in the more northern portions, ranging south to the 40th parallel, approximately, in Utah and California.

In general life-history it is in all respects similar to *C. spretus* which has been so fully treated of in our seventh, eighth, and ninth reports as State Entomologist of Missouri, in the first and second reports of the Entomological Commission, and in the Annual Report of this Department for 1877.* It will be unnecessary, therefore, to give here anything beyond the most salient facts.

The eggs and the egg-mass are so similar to those of *C. spretus* that there is no other difference than in the somewhat smaller size of either. They are laid just beneath the surface of the ground in precisely the same manner. Each female in the course of her life usually deposits two of these masses, though at Saint Louis we have observed instances in which three and even four were placed by the same female. It is in

*This last is now the only one of the reports mentioned which is readily procurable. It contains a résumé of the chapters on habits and remedies from the First Report of the Entomological Commission.

the egg state that the insect passes the winter and the young locusts hatch in the spring.

The average period between hatching and maturity we found at Saint Louis to be eighty days, or some ten days longer than in the case of *C. spretus* and *C. femur-rubrum*, but in New Hampshire it is probably somewhat longer.

In about one week after reaching full growth the insects pair, and soon thereafter commence ovipositing. There is undoubtedly but one annual generation in New England, whereas in Missouri we found uniformly two. In the Merrimac Valley the hatching period extends throughout May, and most of the individuals have become winged by the early part of July. Oviposition continues from the latter part of July till frost. Some of the earlier-laid eggs hatch in autumn, so that there is the same tendency toward a second brood as we find in *spretus*, a tendency which is more marked during a warm, protracted autumn, and which is beneficial to the farmer, inasmuch as all these autumn-hatched individuals invariably perish during the winter.

NATURAL ENEMIES.

The importance of the work of birds in the infested fields need not be enlarged upon here. We have given much attention to the subject in the reports previously mentioned, and it were wise for the farmers of the Merrimac Valley to encourage in every conceivable way the multiplication of the native game birds and to raise domestic poultry liberally.

We shall not add to the long list of insect enemies already given in the first report of the Commission, and indeed comparatively few of these have as yet been found preying upon the Lesser Locust. No blister beetle larvæ have yet been found feeding on the eggs of *Atlanis*, nor have we found any trace of blister beetles in the region we have so far explored.

We have already recorded the curious fact of the finding of the common White Grub (larva of *Lachnosterna fusca*) feeding upon the eggs of *C. spretus*, thus giving, as we stated, "another conclusive proof that an essential vegetable feeder will exceptionally take to soft animal food."

This observation has been repeatedly confirmed at Boscawen, not only with this same White Grub, but by finding also another and smaller species (*Macrodactylus subspinosus*) which is very abundant there, feeding upon the egg-pods of *C. atlanis*.

The carnivorous larvæ of certain Carabid beetles were very common in the fields at Boscawen, feeding upon the locust eggs. Nearly all the pods collected at first were more or less eaten, and there were on an average about three of the predaceous larvæ to each egg mass. In localities, however, where the eggs become more abundant (and one spot was found where 14 sound pods and several empty ones were found in an area of 2 inches square), the proportion of larvæ was less, although their actual numbers were doubtless greater. The commonest of these larvæ were those of *Amara obesa*, Say, and of a species of *Harpalus*, probably *pensylvanicus* or *caliginosus*.

Three undetermined species of Click-beetle larvæ or "wire-worms" have been found feeding on the eggs of *spretus*, and no less than six species were found while searching for the eggs of *atlanis* at Boscawen. But one of these species has been reared and determined, *Drasterius amabilis* LeC. One of the other larvæ appears to be that of *Agriotes*, possibly that of *mancus*.

The young of the Locust Mite (*Trombidium locustarum* Riley), the life-

history of which we have so fully recorded,* likewise infests the mature *atlanis*, while the full-grown mite preys on its eggs; but so far we have found it in comparatively small numbers.

The larva of an Asilid fly was also found feeding upon the eggs. Two species have hitherto been recorded as feeding upon the eggs of *C. spretus*.

The egg parasite (*Bæoneura famelica* Say) which was figured in the first Commission report† has proved quite common at Boscawen, and next to the Carabid larvæ, is, so far, the most efficient destroyer of the eggs of *atlanis*.

REMEDIES.

Destruction of eggs.—It has been demonstrated that the breaking up of the egg-pod and the exposure of the individual eggs to the influence of the weather proves fatal to the embryo, hence we have recommended harrowing the fields in late autumn or during any mild weather in early winter. In the light sandy soil which prevails around Boscawen, we strongly recommend this method in such fields as are in cultivation, and in which the eggs are thickly laid.

As regards deep plowing in late fall and early winter, burying the eggs to a considerable depth, experience varies according to the nature of the soil and the depth of the plowing. But it is strongly to be recommended if done thoroughly, as it not only prevents the bulk of the young locusts from successfully hatching and reaching the surface, but the exceptional ones which survive the operation hatch so much later that they would not affect the first crop of hay.

Destruction of young.—Of the many more or less successful devices for the destruction of the unfledged locusts which we have described in the Commission reports, we shall here mention only the most successful and those which experience has shown can be used with excellent results in New Hampshire. These are trapping pans for the use of coal-oil. Our remarks on this subject in treating of *C. spretus* may here be repeated, the portions thus repeated being in quotation marks:

"*Coal-oil.*—The use of coal-oil and coal-tar may best be considered in this connection, as both substances are employed in various ways for trapping and destroying the insects. As we shall presently see, in considering the different available destructive agents, coal-oil is the very best and cheapest that can be used against the locusts. It may be used in any of its cruder forms, and various contrivances have been employed to facilitate its practical application. The main idea embodied in these contrivances is that of a shallow receptacle of any convenient size (varying from about 3 feet square to about 8 or 10 by 2 or 3 feet), provided with high back and sides, either mounted upon wheels or runners, or carried (by means of suitable handles or supporting-rods) by hand. If the "pan" is larger than, say, 3 feet square, it is provided with transverse partitions which serve to prevent any slopping of the contents (in case water and oil are used) when the device is subjected to any sudden irregular motion, such as tipping, or in case of a wheeled pan, when it passes over uneven ground. The wheeled pan is pushed like a wheelbarrow; the hand-worked pan is carried by long handles at its ends. On pushing or carrying, as the case may be, these pans, supplied with oil,

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* In first Report U. S. Ent. Com., pp. 306–311.

† Described, p. 306, as *Caloptenobia ovivora*, and subsequently referred (2d Rep., p. 270) to *Scelio famelicus* Say. The insect really belongs to Foerster's genus Bæoneura, and not in the genus Scelio, as at present understood.

over the infested fields, and manipulating the shafts or handles so as to elevate or depress the front edge of the pan as may be desired, the locusts are startled from their places and spring into the tar or oil, when they are either entangled by the tar and die slowly, or, coming in contact with the more active portion of the oil, expire almost immediately.

* * * * * * *

"The pans that were used in Kansas and Iowa, but principally in the former State, were of very simple construction and very effectual. We give a description of some of them as they first appeared in Mr. Riley's *Locust Plague in the United States:*

"A good and cheap pan is made of ordinary sheet-iron, 8 feet long, 11 inches wide at the bottom, and turned up a foot high at the back and an inch high at the front. A runner at each end, extending some distance behind, and a cord attached to each front corner, complete the pan, at a cost of about $1.50. (Plate VII, Fig. 2.)

"We have known from 7 to 10 bushels of young locusts caught with one such pan in an afternoon. It is easily pulled by two boys, and by running several together in a row, one boy to each outer rope, and one to each contiguous pair, the best work is performed with the least labor. Longer pans, to be drawn by horses, should have transverse partitions (Plate III, Fig. 8) to avoid spilling the liquid; also more runners. The oil may be used alone so as to just cover the bottom, or on the surface of water, and the insects strained through a wire ladle. When the insects are very small, one may economize in kerosene by lining the pan with saturated cloth; but this becomes less efficient afterward, and frames of cloth saturated with oil do not equal the pans. Where oil has been scarce, some persons have substituted concentrated lye, but when used strong enough to kill its cost about as much as the oil. The oil-pans can be used only when the crops to be protected are small.

"Small pans for oil, attached to an obliquing pole or handle, do excellent service in gardens."

A coal-oil pan to be drawn on runners is shown at Plate VII, Fig. 1. It is made as follows:

Take a common board from 12 to 16 feet in length for the foundation or bed-piece. Make a tin trough 4 inches deep, 6 inches wide, and as long as required. Divide the trough into partitions by means of strips of tin, so that each partition is a foot long, thus avoiding the spilling of oil. Back of this place a strip of tin 16 inches wide and as long as the trough. The back must be firmly secured by braces running down to the front edge of the board. Under all this place three wooden runners 3 feet long and shod with iron for the troughs to ride on. Fill the pan half full of water and then add a small quantity of kerosene—sufficient to cover the water. A horse may be hitched to the machine by fastening a rope to the outside runners. The lightness of the machine will allow its being used on any crops.

This machine was used with much success in Northern Iowa during the last incursion of *C. spretus*.

"A contrivance is shown in Plate VII, Fig. 3, constructed by President John A. Anderson, for use on the Agricultural College farm at Manhattan, Kans. The following description is taken from the *Industrialist:*

Yesterday afternoon we had the following cheap machine built in a couple of hours which thus far promises to do all the work of either of the oil-machines: Three pieces of fence-board, 4 feet long and 3 or 4 feet apart, serve as sled-runners. To the front end is nailed a fence-board 15 or more feet long. To this and over the runners, three pieces of slats, each 4 feet long, are attached by a leather hinge; and inch-and-a-half holes through the back end of these slats receive light standards, the lower ends of which are fastened to the back ends of the runners by a leather hinge. Peg-holes in the upper half of the standards enable you to place the slats at any desirable angle. On the back ends of these slats is nailed a strip 15 feet long, parallel with the fence-board and 3 feet from it, and to these is tacked coarse muslin 15 feet in length which forms an apron or movable screen that can be set at any angle. To the front ends of the outside runners a long piece of fence-wire was attached, and a mule was hitched to the wire, much to the disgust of the mule. A boy can pull the light machine, but mules pull longer than boys do. On trial it worked to a charm; and this morning the ground gone over shows several dead hoppers to the square foot, notwithstanding the fact that they had quickly jumped off the apron. It should be used against the wind, and promises to be very effective. Any man can make the above in two hours, and it is worth trying.

EXPLANATION TO PLATES.

PLATE I.

CABBAGE WORMS.

(Original.)

FIG. 1. *Pieris rapæ* ♀.
FIG. 1*a*. *Pieris rapæ* ♀, ovipositing.
FIG. 1*b*. *Pieris rapæ* ♂
FIG. 1*c*. *Pieris rapæ*, larvæ of different stages.
FIG. 1*d*. *Pieris rapæ*, chrysalis.
FIG. 2. *Plusia brassicæ*. larva.
FIG. 2*a*. *Plusia brassicæ*, pupa and cocoon.
FIG. 3. *Mamestra picta*, larva.
FIG. 3*a*. *Mamestra picta*, moth.
FIG. 4. *Pionea rimosalis*, larva.
FIG. 4*a*. *Pionea rimosalis*, moth.
FIG. 5. *Mamestra chenopodii*, larva.
FIG. 6. *Plutella cruciferarum*, larva.
FIG. 6*a*. *Plutella cruciferarum*, pupa.

PLATE II.

THE LESSER LOCUST.

(From Report I, U. S. E. C.)

FIG. 1. *Caloptenus atlanis*, newly hatched or in first larval stage, from side; 1*b*, same, while yet pale, from above; 1*a*, antenna of same.
FIG. 2. Second stage; 2*a*, antenna; 2*b*, thorax, from above; 2*c*, thorax, from side.
FIG. 3. Third stage; 3*a*, antenna; 3*b*, thorax, from above; 3*c*, thorax, from side.
FIG. 4. Fourth stage, or first pupal stage; 4*a*, antenna; 4*b*, thorax, from above; 4*c*, thorax, from side.
FIG. 5. Fifth stage, or true pupa; 5*a*, antenna; 5*b*, thorax, from above; 5*c*, thorax, from side; 5*d*, pupal exuviæ, or last skin shed.
FIG. 6. Sixth stage, or mature insect; the figure showing a typical male—natural size.
FIG. 7. Typical female, with wings expanded—natural size.
FIG. 9. Enlarged thorax of mature insect, from above; 9*a*, same, from side.
FIG. 10. Anal characters of male, from above; 10*a*, same, from side; 10*b*, same, from behind.
FIG. 11. Anal characters of female, from side; 11*a*, anal characters of female, from above.

PLATE III.

FOREST TREE INSECTS.

(Original.)

FIG. 1. *Nematus erichsonii*, female (enlarged).
FIG. 1*a*. *Nematus erichsonii*, outline (natural size).
FIG. 1*b*. *Nematus erichsonii*, larvae of different stages.
FIG. 1*c*. *Nematus erichsonii*, cocoon.
FIG. 1*d*. Larch twig denuded by *N. erichsonii*.
FIG. 2. *Gelechia abietiscida*, adult (enlarged).
FIG. 2*a*. Twig of spruce damaged by *G. abietiscida*.
FIG. 3. *Tortrix fumiferana*, male (enlarged).

PLATE IV.

HAND-BLOWER FOR UNDERSPRAYING AND POWDERING WITH INSECTICIDES.

(Original; W. S. Barnard, *del.*)

FIG. 1. *Direct powder blower*; bellows, *v*; hollow handles, *h*; powder can, *p*; to discharge, *s*; feed adjustor, *j*; screw-cap, *y*.
FIG. 2. *Powder-can in section*; blast tube, *ev*; side slot and feed regulator, *oj*; body of can, *p*; screw-cap, *y*.
FIG. 3. *Exterior view of can with crooked extension pipe*; pipe, *e l u*; can, *p*; screw-cap, *y*; gauge, *j*; upward discharge, *s*.
FIG. 4. *Bellows, can and straight extension pipe with its discharge*; bellows, *v*; head, *j*; gauze valve cover, *z*; handle, *h*; can, *p*; couple, or hose, *r*; pipe, *i*; discharge, *s*.
FIG. 5. *Compact bellows-can arrangement*; can, *pp*; screw-cap, *y*; handle, *h*; valve gauze, *z*; head, *j*; discharge pipe, *h, e, r, c*.
FIG. 6. *Hand bellows spray blower*; bellows, *v*; gauze valve, *z*; handle, *h*; discharge pipe, *h y r i s*; spray, *s*; screw-cap couple, *y*; can, *p*; apex, *x*; bases, *a n*; supply tube, *l*.
FIG. 7. *Liquid can in section*; blast pipe, *y*; can, *p*; suction pipe, *x p y*; blast inlet, *y*; apex, *x*; bases, *a n*; supply tube, *l*.
FIG. 8. *Mouth spray-blower with direct discharge*; mouth piece, *o*; blast tube, *t e j s*; couple, *c*; screw-cap, *j*; can, *p*; apex, *x*; bases, *a n*; supply tube, *l*.

PLATE V.

KNAPSACK PUMP UNDERSPRAYER AND APPURTENANCES FOR APPLYING INSECTICIDES.

(Original; W. S. Barnard, *del.*)

FIG. 1. *Knapsack pump undersprayer in operation*; loops, *b b*; support can, *k*; suction hose, *r h c*; ejector-pump, *c x*; piston rod extension, *x i u*; to eddy chamber nozzle, *u*; side spray, *s*.
FIG 2. *Eddy chamber nozzle*, natural size; face view and section.
FIG. 3. *Eddy chamber nozzle*, *f*, for direct discharge.
FIG. 4. *Trailing pipe fork*; its stem pipe, *t*; y-fork, *g*; inside spring rods, *s j s*; flexile joints, *e e*; drag-plate, or shoe, *e e*; nozzle arm-pipes, *i i*; their swing, *m n m*; nozzles, *n n*.

PLATE VI.

DEVICES FOR UNDERSPRAYING TREES WITH INSECTICIDES.

(Figs. 1 and 2 original; 3 and 4 from Ann. Rept. Dept. Agr. 1881–'2.)

FIG. 1. *Parts of hose-pole device for spraying trees;* bamboo pole, *b b;* drip washer, *j;* hose, *h x;* side hook, *v;* eddy chamber nozzle, *n m;* spray, *z s.*

FIG. 2. *Metallic hand pipe with diagonal nozzle;* hose, *h;* metallic pipe, *t;* diagonal eddy chamber nozzle, *n;* its removable face, *i;* spray, *s.*

FIG. 3. *Barrel rest or skid;* two coupling cleats, *b b;* two side rests, *a a;* chamfered concave, *c c.*

FIG. 4. *Stirrer pump with barrel and mixer funnel in section;* funnel, *u;* its cylindrical sides, *g g;* funnel base, *t t;* spout, *p;* (in bung-hole, *k*), gauze septum, *d;* barrel, *k k;* trunnions, *i;* trunnion eyes, *e;* wedge, *v;* lever-fulcrum, *f;* pump lever, *i i;* swing of the lever head and piston top, *a b c;* cylinder packing cap, *c;* cylinder, *q;* its swing, *x y;* stirrer loop or eye, *h;* stirrer bar, *m n;* rope, *w w;* bung, *r z.*

PLATE VII.

(From Rept. I, U. S. E. C.)

FIG. 1. Coal-oil pan, large size.

FIG. 2. Coal-oil pan, small size.

FIG. 3. The Anderson Coal-oil contrivance.

PLATE VIII.

(From Rept. I, U. S. E. C.)

FIG. 1. The Robbins Coal-tar pan.

FIG. 2. The Flory Locust-Machine, front view—in operation.

FIG. 3. The same, side view of frame.

PLATE IX.

(From Rept. I, U. S. E. C.)

FIG. 1. The Riley Locust Catcher.

PLATE X.

CABBAGE WORMS.

(Fig. 1 original; 2, 3, 4 after Riley; 5 after Harris.)

FIG. 1. *Pieris monuste; a,* larva; *b,* pupa; *c,* adult.

FIG. 2. *Pieris protodice,* ♂.

FIG. 3. *Pieris protodice,* ♀.

FIG. 4. *Pieris protodice; a,* larva; *b,* pupa.

FIG. 5. *Pieris oleracea; a,* larva.

PLATE XI.

(Figs. 1, 3, 4, 5, and 6 original; 2 after Riley.)

FIG. 1. *Phymata erosa; a,* dorsal view (enlarged); *b,* side view (enlarged); *c,* front leg (enlarged); *d,* rostrum (enlarged).

FIG. 2. *Plusia brassicæ; a,* larva; *b,* pupa; *c,* moth.

FIG. 3. *Plutella cruciferarum; a,* larva (enlarged); *b,* dorsum of a single joint (greatly enlarged); *c,* side view of same; *d,* pupa (enlarged); *e,* cocoon (enlarged); *f,* moth (enlarged); *g,* wings of dark variety (enlarged); *h,* moth at rest (enlarged); *i,* cremaster of pupa (greatly enlarged).

FIG. 4. *Pionea rimosalis; a,* larva; *b,* pupa; *c,* moth; *d,* segment of larva (enlarged).

Fig. 5. Larva of *Plusia brassicæ* parasitized by *Copidosoma truncatellum.*

FIG. 6. *Copidosoma truncatellum* (greatly enlarged).

PLATE XII.

(Figs. 1 and 3 original; 2 after Riley.)

FIG. 1. *Mamestra chenopodii; a, b,* larva; *c,* pupa; *d,* moth; *e,* wing of same (enlarged); *f,* anal segment of pupa.

FIG. 2. *Ceramica picta; a,* larva; *b,* moth.

FIG. 3. *Galeruca xanthomelæna; a,* eggs; *b,* larvæ; *c,* adult; *e,* eggs (enlarged); *f,* sculpture of eggs; *g,* larva (enlarged); *h,* side view of greatly enlarged segment of larva; *i,* dorsal view of same; *j,* pupa (enlarged); *k,* beetle (enlarged); *l,* portion of elytron of beetle (greatly enlarged).

PLATE XIII.

(Original; Packard—Gissler, *del.*)

FIG. 1. *Nematus erichsonii?* head of larva before last molt.

FIG. 1*a.* Same, full-grown larva.

FIG. 2. Maxilla of same, from above; *g,* galea; *lac,* lacinia; *palp,* palpus.

FIG. 3. Same, underside; *mx.* maxilla; *mxp,* maxillary palpus; *mx′,* labium; *mx′p,* labial palpus.

FIG. 4. Mandible of same.

FIG. 5. Pteromalus parasitic on same.

FIG. 6. *Nematus integer,* head and thorax; *psc,* praescutum; *sc,* scutum; *scl,* scutellum.

FIG. 6*a.* Same, ovipositor; 9, 10, 9th and 10th abdominal segments; *ov,* ovipositor; *c,* cercopod.

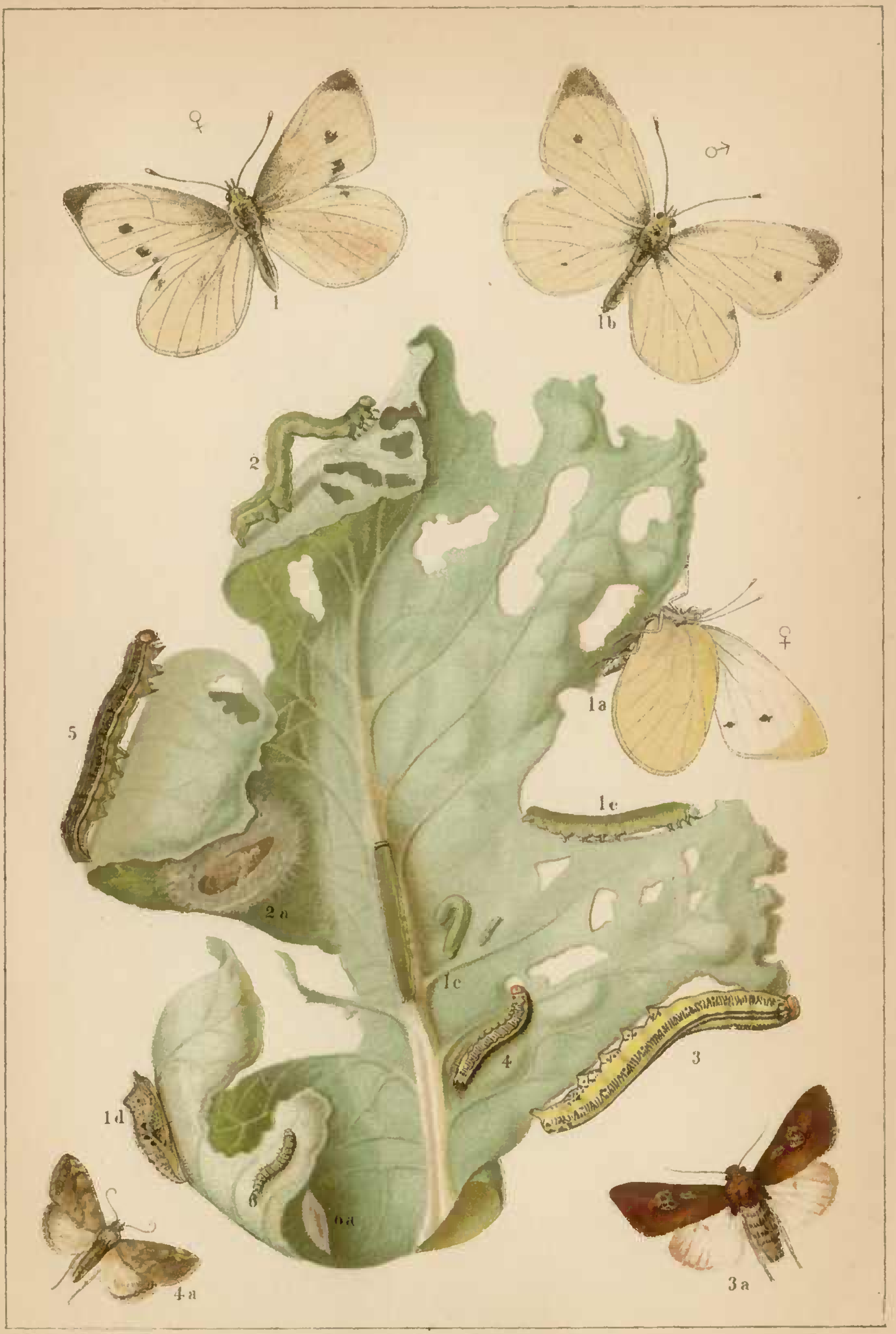
FIG. 6*b.* Same, wing.

FIG. 6*c.* Same, antenna.

FIG. 7. *Gelechia abietisella,* larva enlarged (natural size indicated by hair line).

FIG. 7*a.* Same, head and thoracic, and first abdominal joints more highly magnified.

FIG. 7*b.* Same, terminal joints on same scale as last. All the figures magnified.



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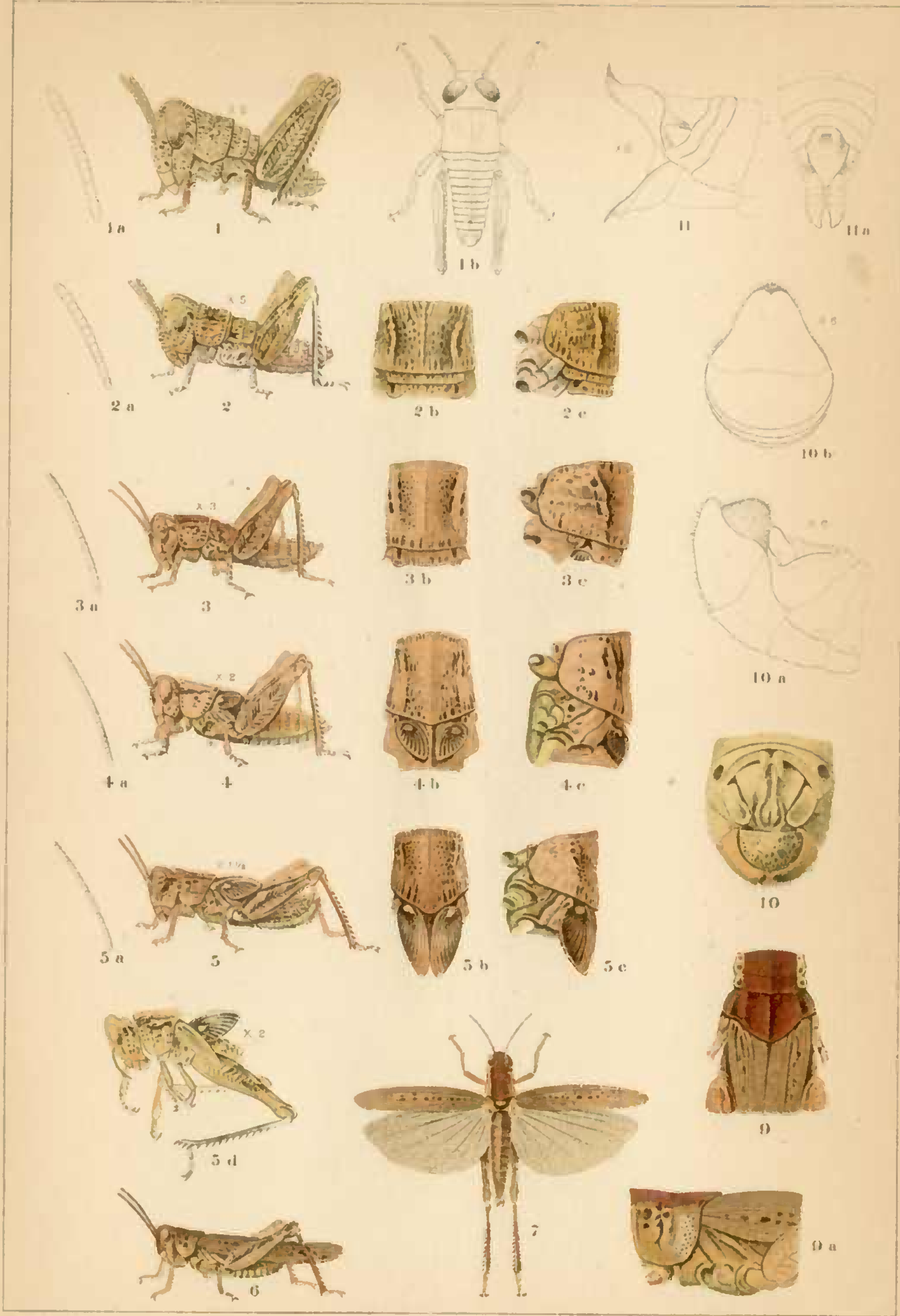
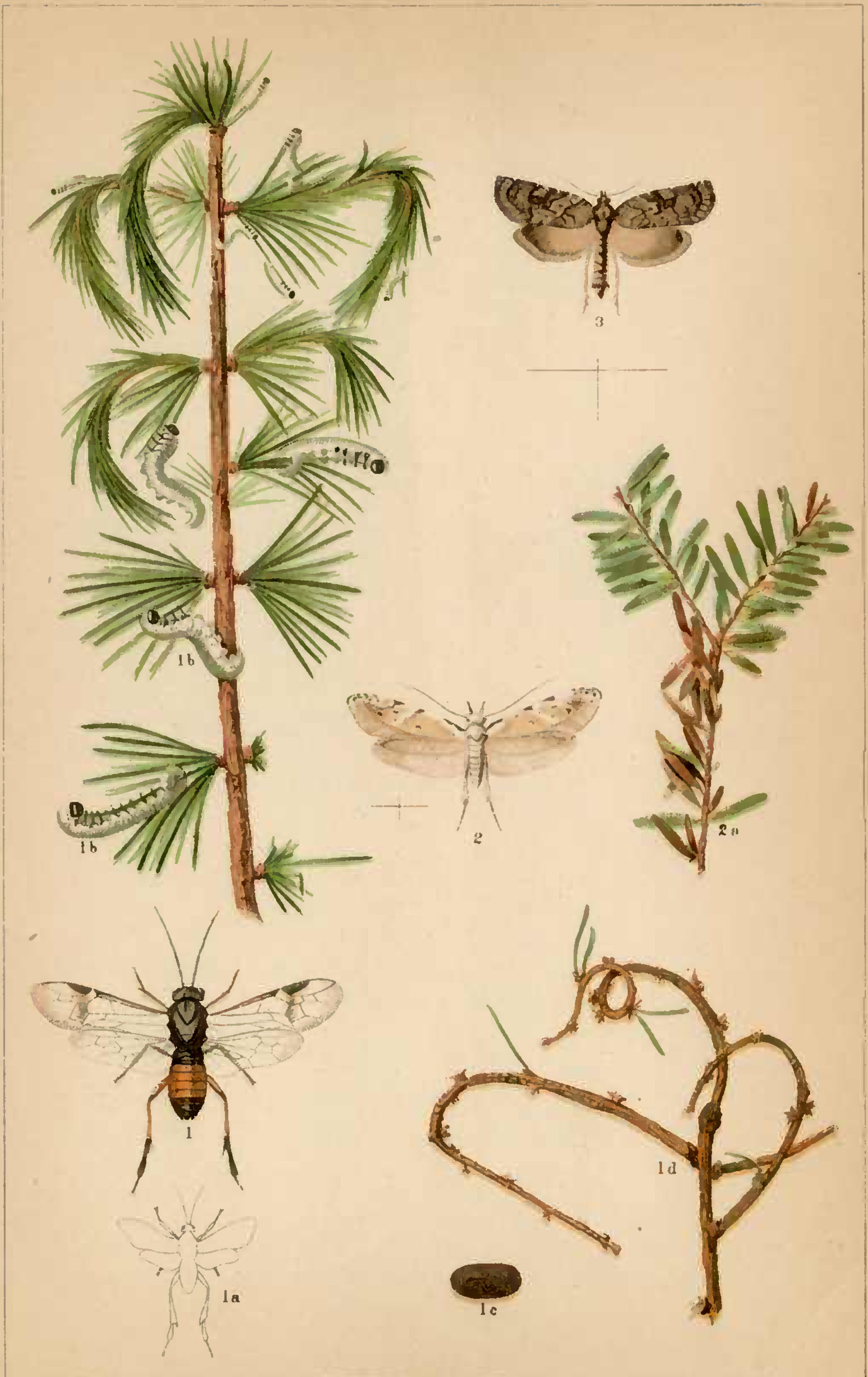
CABBAGE WORMS.



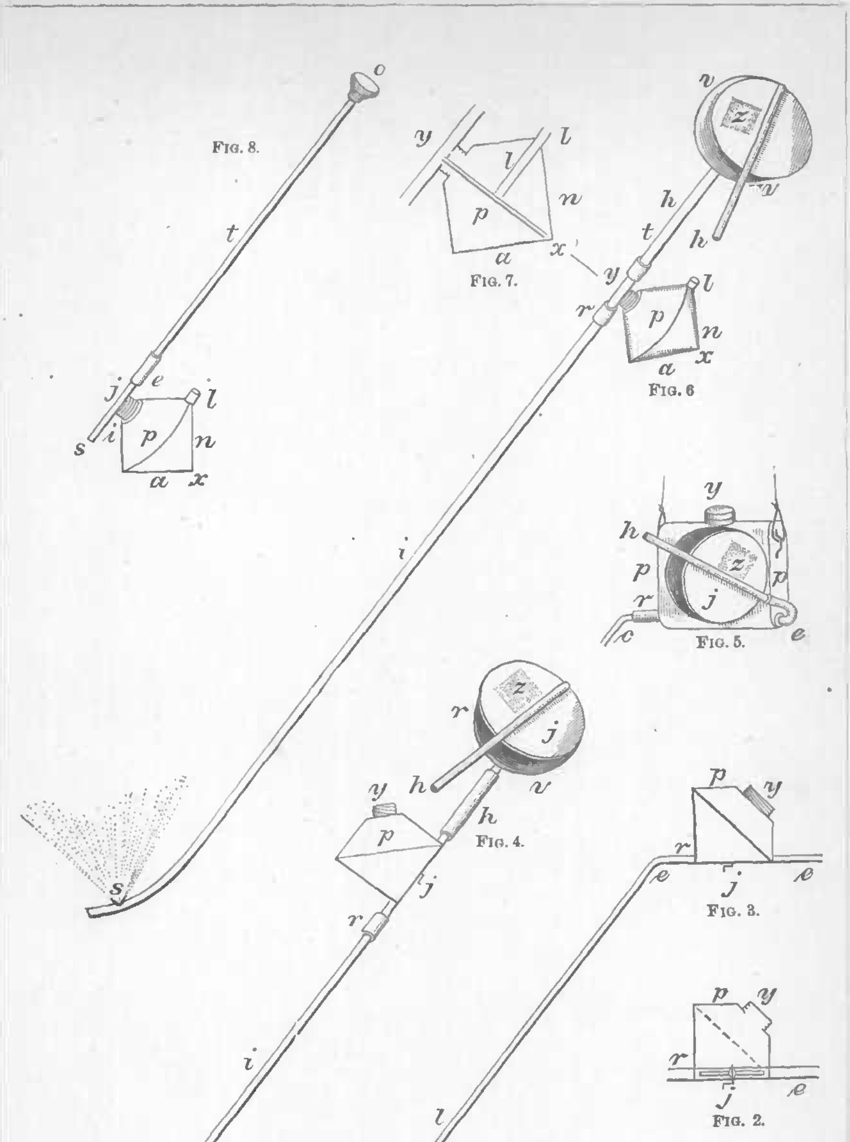
Drawn by J. H. Emerton.

LESSER LOCUST.
(Caloptenus atlanis)



Lillie Sullivan pinx.

LARCH AND SPRUCE INSECTS.



HAND SPRAY BLOWERS.

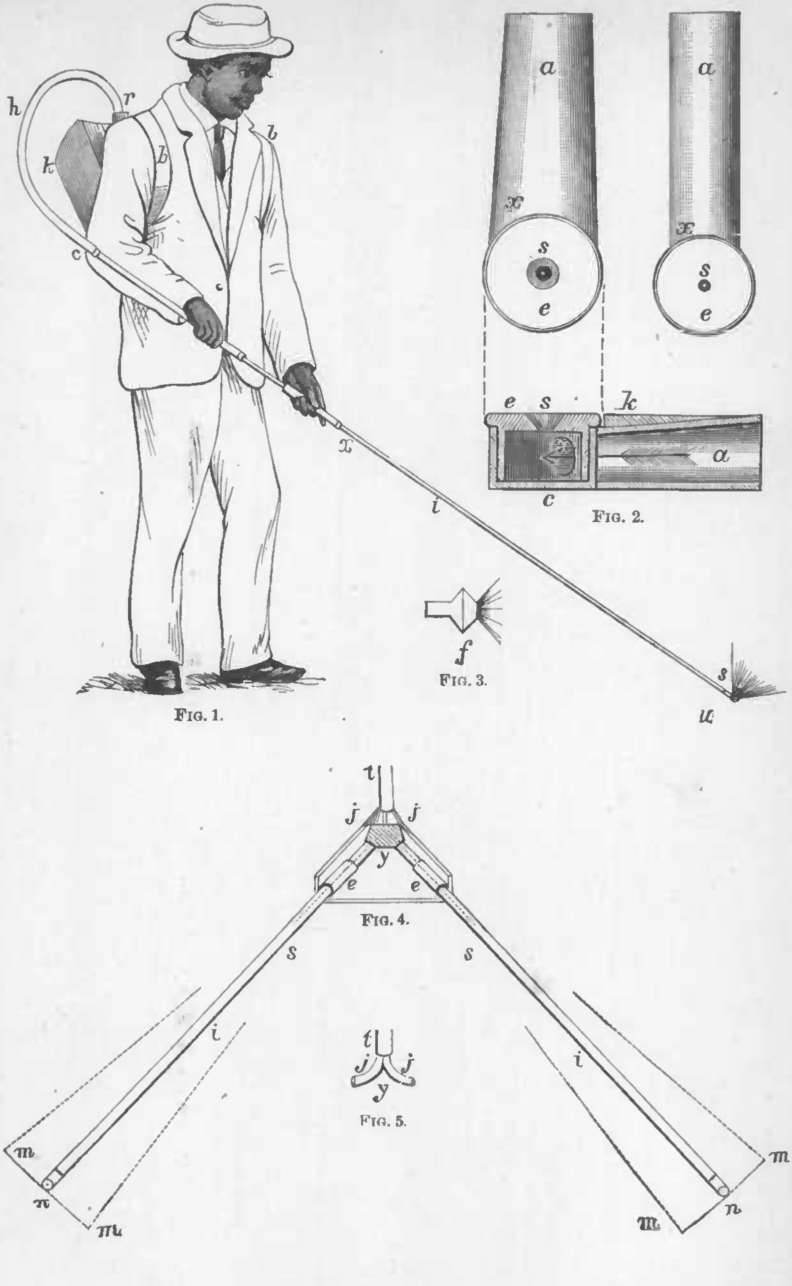


FIG. 1.

FIG. 2.

FIG. 3.

FIG. 4.

FIG. 5.

KNAPSACK SPRAY EJECTOR.

Fig. 2.

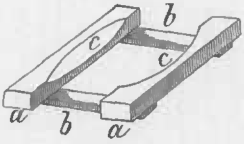


Fig. 3.

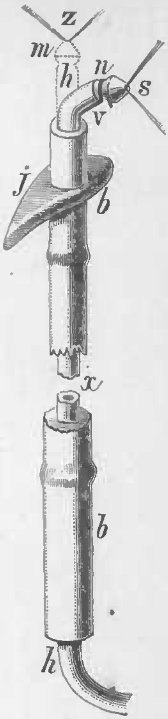


Fig. 1.

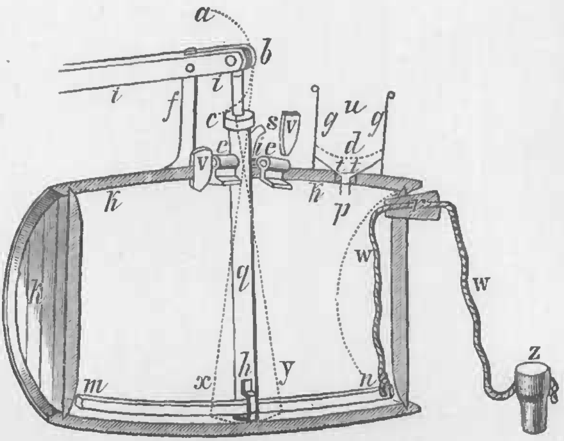


Fig. 4.

DEVICES FOR UNDERSPRAYING TREES.

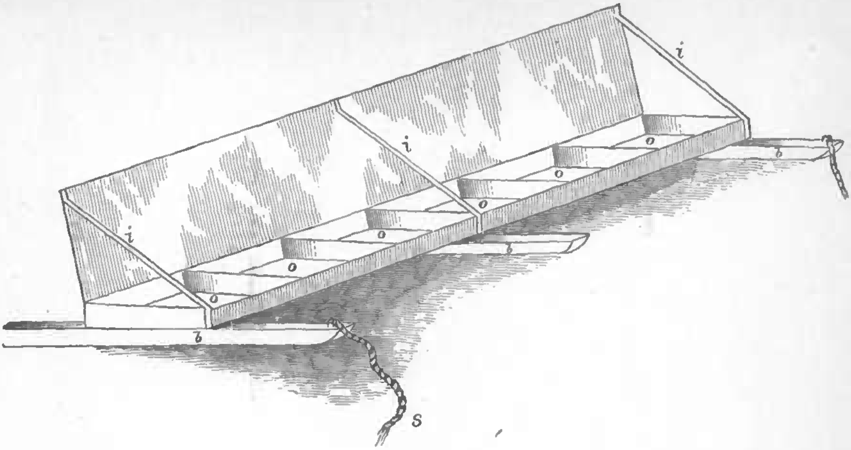


FIG. 1.

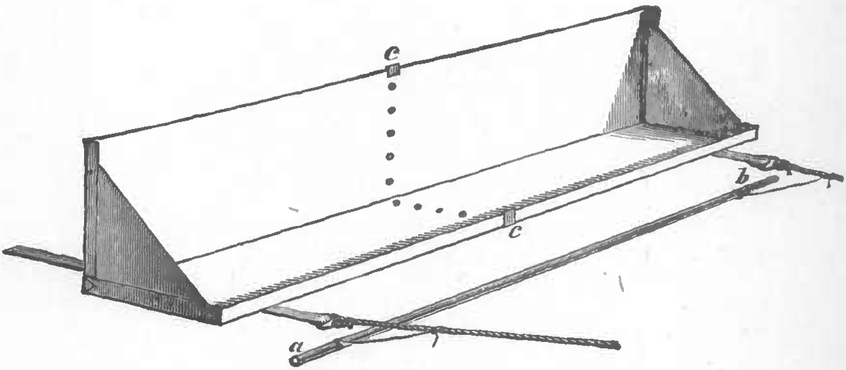


FIG. 2.

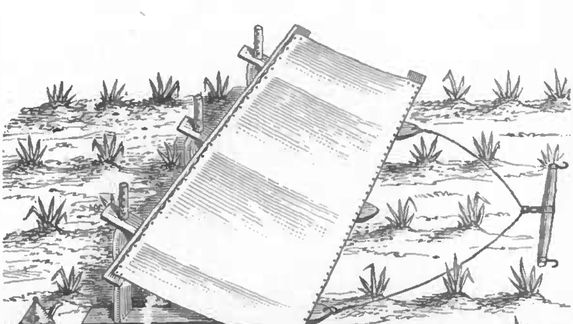


FIG 3.

COAL-OIL PANS FOR KILLING LOCUSTS.

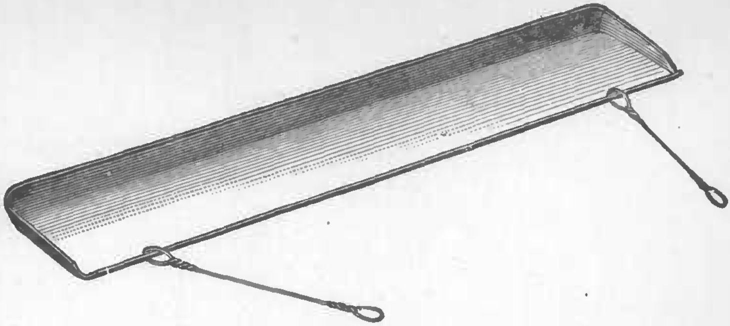


FIG. 1.

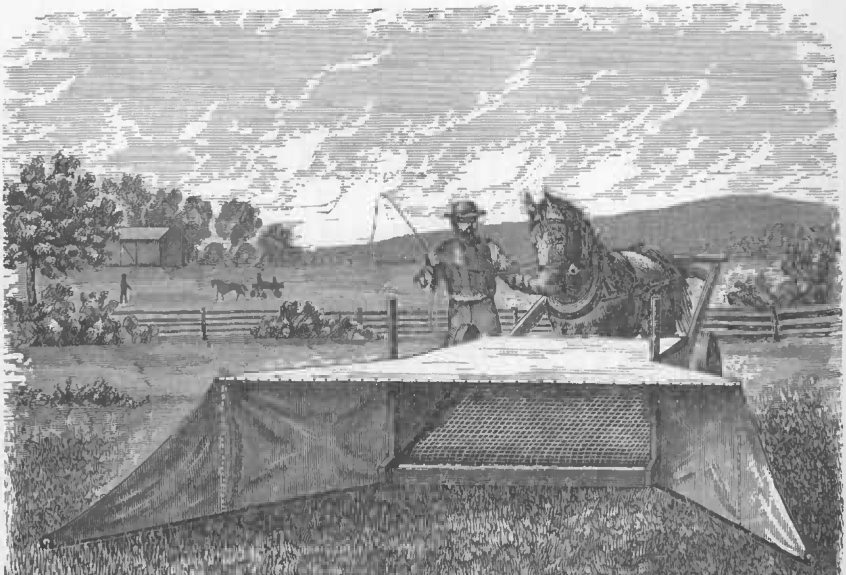


FIG. 2.

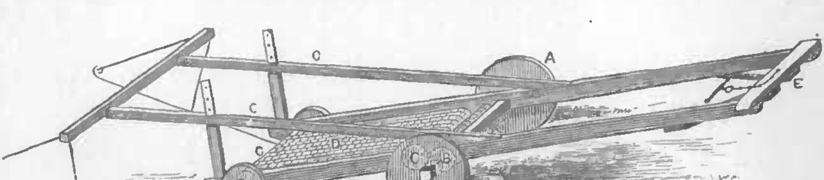


FIG. 3.

COAL-TAR PAN AND FLORY LOCUST MACHINE.

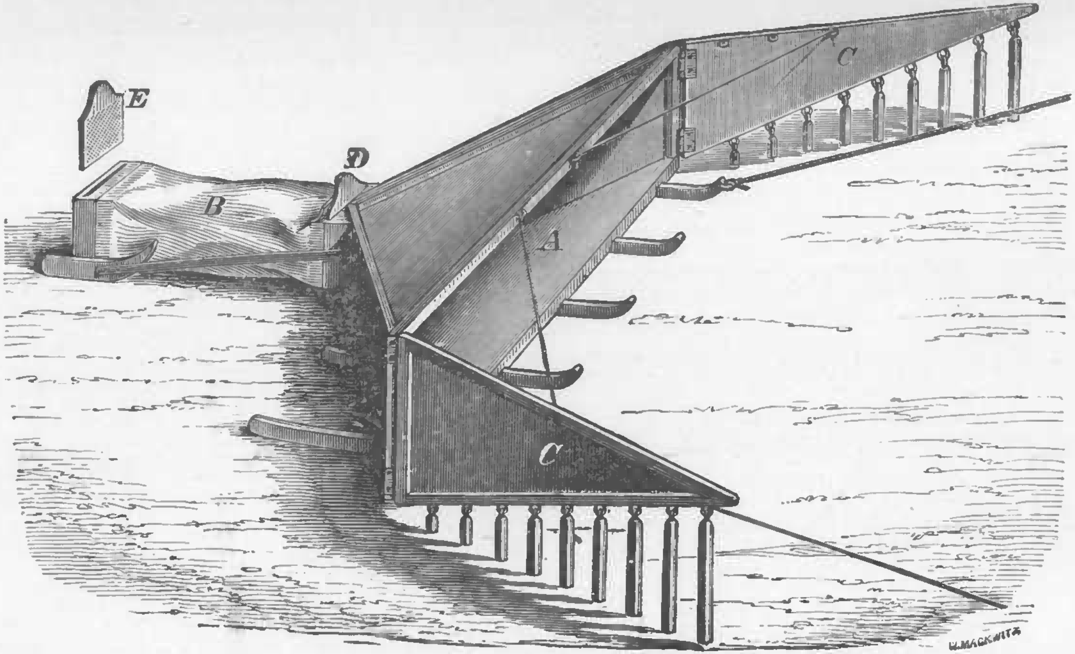


FIG. 1.

THE RILEY LOCUST CATCHER.

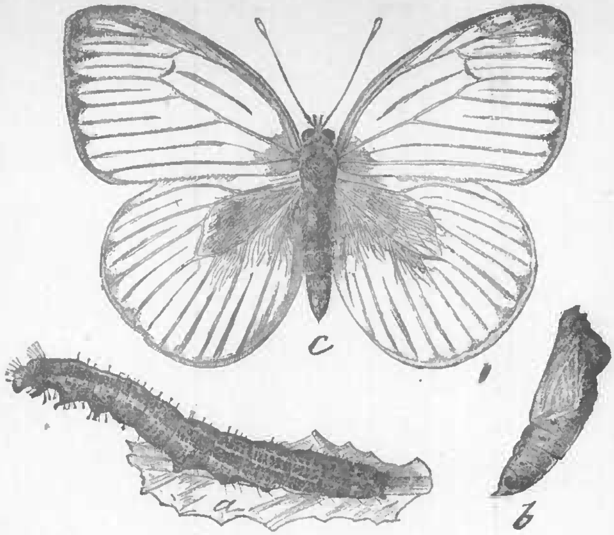


Fig. 1.

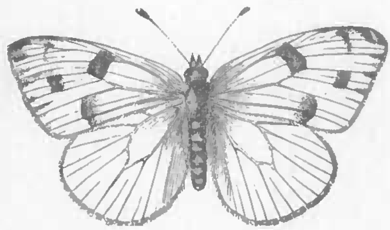


Fig. 2.

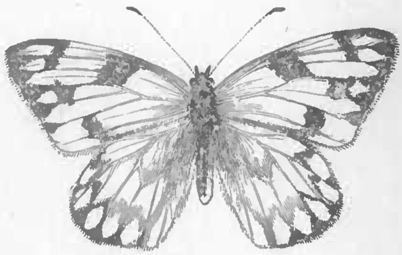


Fig. 3.

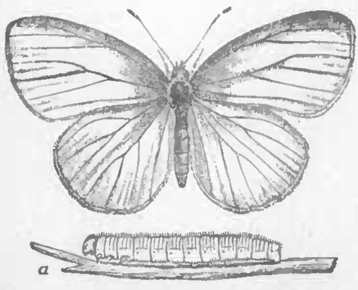


Fig. 5.

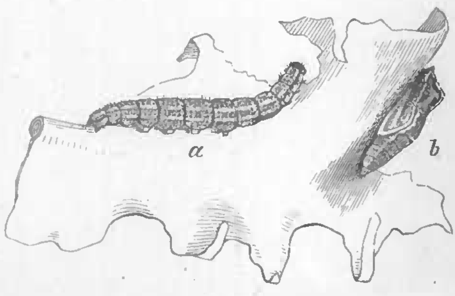


Fig. 4.

Cabbage Worms.

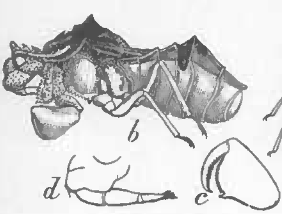


FIG. 1.

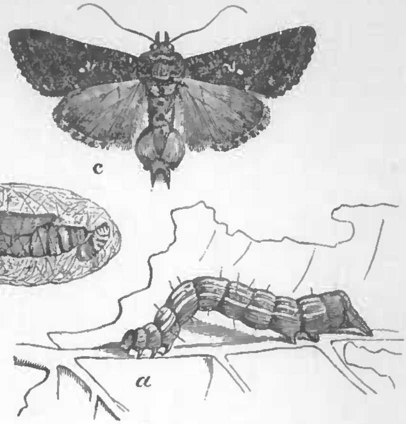


FIG. 2.

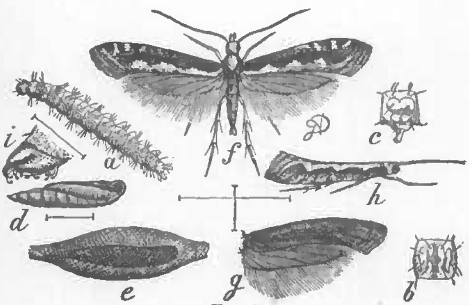


FIG. 3.

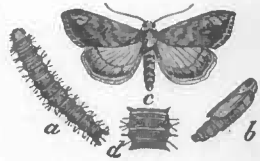


FIG. 4.

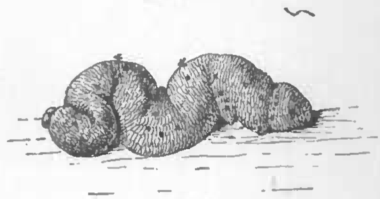


FIG. 5.

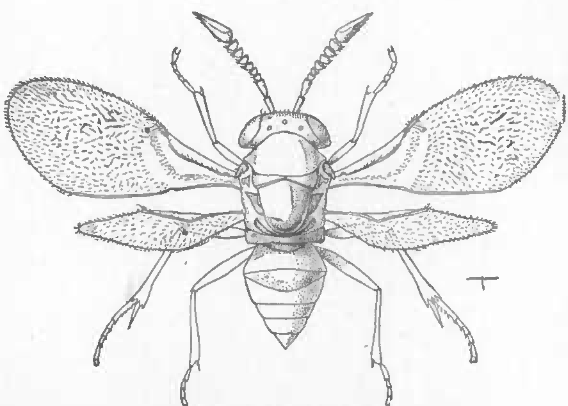


FIG. 6.

CABBAGE WORMS AND THEIR ENEMIES.

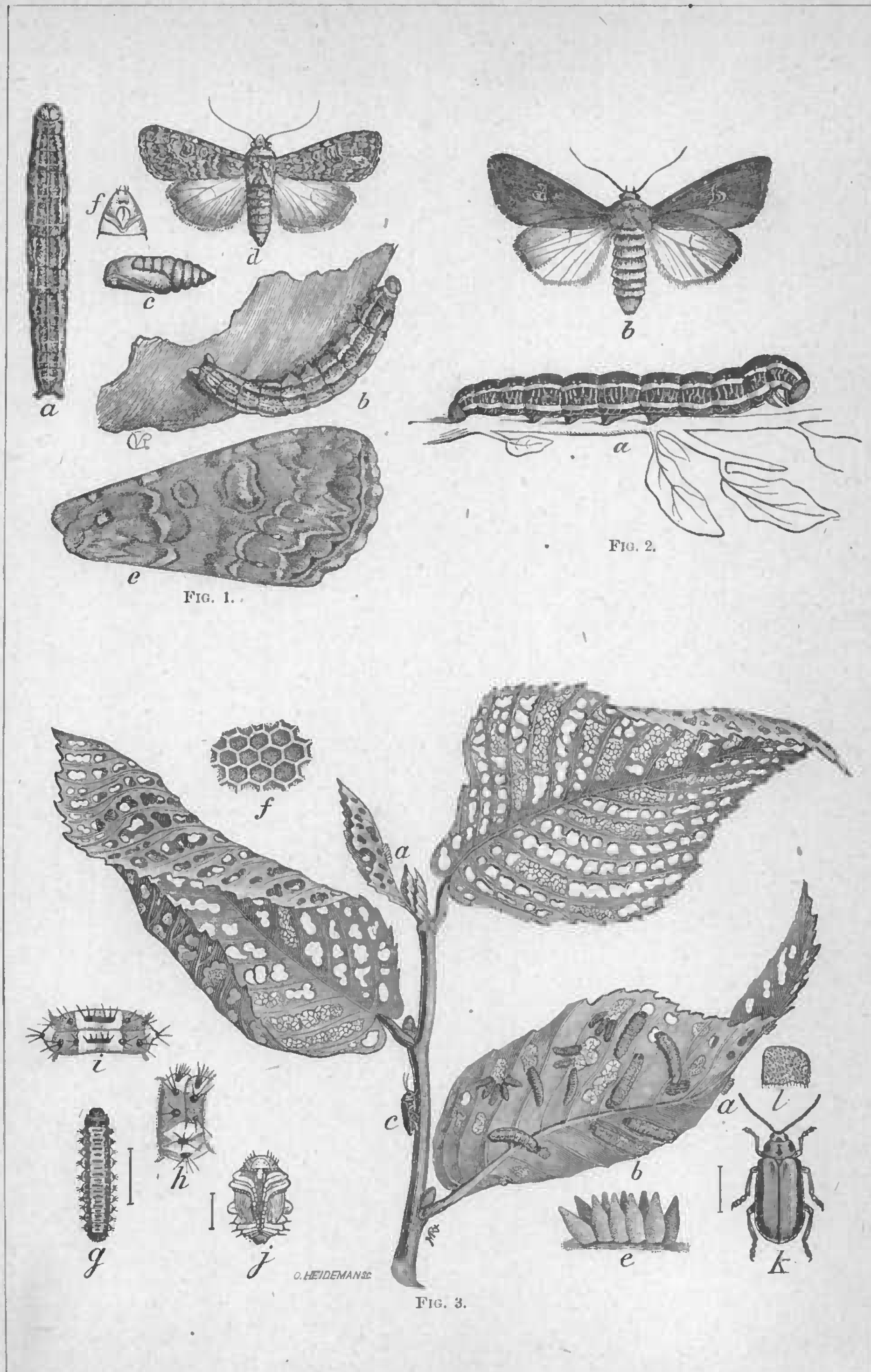
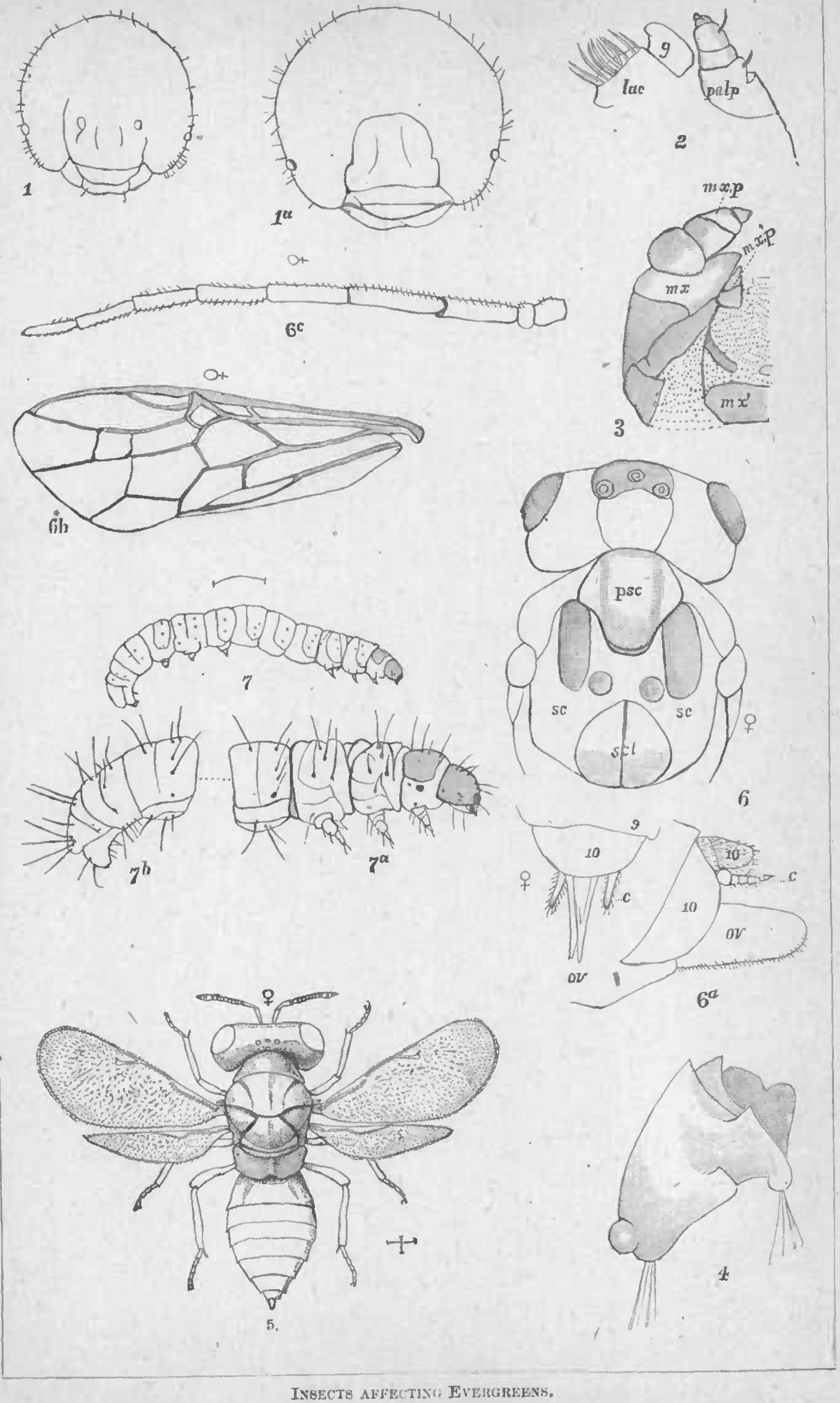


FIG. 1.

FIG. 2.

FIG. 3.

1, 2. CABBAGE WORMS. 3. ELM LEAF BEETLE.



INSECTS AFFECTING EVERGREENS.

It was found to do very good service, killing the young locusts in considerable numbers. The oil did not evaporate so rapidly as was anticipated. One thorough saturation was sufficient for fifteen or twenty minutes, when a little more could be added. If the machine be hauled against the wind nearly all the locusts which hop will touch the oiled canvas. They generally take several hops upon the canvas before leaving it, thus insuring a thorough saturation with the oil. After hopping from the apron they can take two or three hops upon the ground, then lose all power in their hind legs, stretching them straight out behind, and finally, in one or two minutes after being "oiled" they are dead.

The use of the kerosene pan in New Hampshire has met with an abundant measure of success, although the experiments were begun this year rather too late. From the second week in June on, daily draggings were made on at least six farms, and as many as a bushel of locusts taken in an hour from a single pan without reckoning those which had jumped out and died on the ground from the effects of contact with the kerosene. On the farm of Mr. J. K. Chandler, where we made our first experiments, operations were begun early in June and steadily continued until the locusts became full fledged. On one occasion fifteen bushels were gathered in one hour, and upon an adjoining farm a bushel were taken in two minutes. On a four-acre field to the north 36 bushels were caught in two days. Instead of the pure kerosene thrown into the pans, either with or without water, as heretofore used in the West, we found that the kerosene emulsion, which will be more particularly referred to further on, acted admirably when diluted even with 50 to 100 parts of water, while the locusts were young; so that as a matter of economy and convenience the use of the oil in this form well repaid the trouble of preparation, which rarely requires more than from five to ten minutes of churning with an ordinary aquapult.

"*Coal-tar.*—This may be used with most of the contrivances just described for the use of kerosene, and while not equal to the simple kerosene pan for speed in trapping and destroying, is yet very useful, especially in the neighborhood of gas-works, where the coal-tar can be obtained at a nominal cost. It also permits of the use of the simplest kind of pan. Enough tar is spread over whatever receptacle may be used to cover well the bottom, and when this becomes sufficiently matted with the young locust so as no longer to destroy the newcomers, another coating is added, and so on until it becomes necessary to remove the whole mass, when it is shoveled from the pan and burned, or, what is far preferable, wherever there are wet ditches, it may be thrown into these, when the oil contained in it, spreading over the surface of the water, destroys such locusts as may jump into or be driven into such ditches. Where the tar is scarce, as a matter of economy it will pay to melt the accumulated mass in iron vessels. By skimming off the dead locusts that rise to the surface and thinning the residuum with a little coal-oil, it may be used again.

A simple pan which was very extensively used in the West is shown at Plate VIII, Fig. 1, and was known as the "Robbins hopperdozer." Its general plan is that of an ordinary road-scooper, and its simplicity and durability account for its general use. It was usually drawn by hand, though several pans were frequently bound together and drawn by horses; while in some instances certain improvements in the way of mounting on wheels, so as to permit its being pushed from behind, were also adopted. We saw some with a wire screen, or cover, hinged to the back so that the insects might be secured when the pan was not in motion, but the cover seemed superfluous. We also saw lime and kerosene mixed so as to form a mortar substituted for the coal-tar.

On Plate VIII we have also represented a machine which may be used either with coal-tar or as a catching and crushing machine. It

was invented by J. S. Flory, and manufactured by Flory & Co., Greeley, Colo. The details of the machine and its method of work are as follows:

The main feature of this invention is a revolving platform of heavy canvas or wire cloth, which runs between two horizontal rollers. Long arms reach forward, which support a revolving reel; from these arms downward extend sheet-iron sides, over the top a canvas covering; all so constructed as to form a large, wide mouth, into which the 'hoppers are driven by the arms of the revolving reel and carried between the two rollers and crushed. Horizontal strips running along the rollers serve to keep the rollers and platform clear of the crushed grasshoppers. The whole machine is supported on two main wheels about the middle, and two smaller ones in front. Extending back is a frame or cross-bar, to which one or two horses may be hitched to push the machine forward, or it may be operated by hand. The front of the platform runs close to the ground, and by bearing down at the rear by the driver, it can easily be lifted over any obstruction that may be in the way. The machine can be raised or lowered in front to suit the crop over which it is run.

This invention will destroy the grasshoppers without the necessity and expense of using oil or tar. The patent, we understand, also covers the combinations of a receptacle immediately under the rollers, into which the grasshoppers are carried, and into which, if need be, water and oil may be kept, and also a long narrow hopper (just over the rollers), into which coal-tar may be put and allowed to run through on to the platform, thus making it a *self-tarring machine*. Either of these combined methods of destroying the 'hoppers may be used as the farmer may choose. The machine is so simple in costruction that any ordinary workman can put them up at a comparatively small price. The machine may be made of any size desired, from a small hand-machine to one a rod or more in width.

Plate VIII, Fig. 2, represents a front view of this machine when in operation, and Fig. 3 a side view of the frame. The manufacturers send us the following description:

The rollers B and C^1 are 8 feet between the side-pieces. The roller B, forming the axle, is about 16 inches longer than the other. The wheels are 24 inches in diameter, 4 inches thick, made of pieces of 2-inch lumber. Front roller, C, 8 feet between side-pieces, 4 inches in diameter. Front wheels 10 inches in diameter, so set as to let the front roller and platform run within a few inches of the ground. Front wheels should be on movable axles, so as to raise or lower the machine. The platform is made of heavy ducking, endless, and revolves between the two rollers B and C^1. A head-block and key at each end is used to drive the roller C^1 up tight against the axle B. Side-pieces are made of scantling 2 by 6, 7 feet in front, 9 feet in rear of axle. Arms, G G, 2 by 2, so arranged as to raise or lower the cover P. Cross-piece in front of roller C (diagram 2), set so close as to serve as a cleaner to the platform, also protects the platform from rocks, &c. A short apron is attached to this piece, extending to the ground. (If necessary, a cleaner-strip may be placed immediately under roller C^1 (diagram 2).) W are canvas wings, extending forward and outward at an angle for the purpose of driving the grasshoppers in from either side; and as the machine advances, they jump onto the movable platform and are carried into the rollers B and C^1 (diagram 2) and crushed. X X are iron rods hanging by ropes from the end of front cross-piece T. V V are wires extending from end of iron rods to cross-piece T. To the iron rods and wire the canvas sides are sewed. An apron of canvas hangs from the iron rods X X to sweep the ground. Over the top to the pieces C C a canvas cover is placed, tacked on, extending back to the cross-piece F. The sides are also closed up with canvas.

"*Catching or bagging.*—There are innumerable mechanical contrivances for this purpose. The cheapest and most satisfactory are those intended to bag the insects. A frame two feet high and of varying length, according as it is to be drawn by men or horses, with a bag of sheeting tapering behind and ending in a small bag or tube, say one foot in diameter and two or three feet long, with a fine wire door at the end to admit the light and permit the dumping of the insects, will do admirable work. The insects gravitate toward the wire screen, and when the secondary bag is full they may be emptied into a pit dug for the purpose. These bagging-machines will prove most serviceable when grain is too high for the kerosene pans, just described, and they will be rendered more effectual by having runners at distances of about every two feet, extending a foot or so in front of the mouth, so as to more thoroughly disturb the insects

and prevent them from getting underneath; also by having wings of vertical teeth, so as to increase the scope with as little resistance to the wind as possible.

"Two important facts should always be borne in mind in using these bagging-machines: 1st, that they should always be drawn, as far as possible, against the wind, if this be stirring; 2d, that in proportion as the insects and the grain are advanced in growth, and the former become predisposed to roost, in that proportion the machines will prove more serviceable at night."

We constructed a machine in 1876 embodying the features already mentioned, and it answered the purposes very well indeed. (See Plate IX.) We reproduce the following account from the *Scientific American:*

"The mechanical department has constructed a new locust exterminator for Professor Riley. The machine operates upon the bagging principle. It is, briefly, a large canvas bag stretched upon a light but strong frame, and placed upon runners, which extend with curved tips a little in front of the mouth. The canvas is stretched upon the inside of the frame, thus making the bag smooth and even within. This bag has a mouth (A) ten feet long and two feet high, and converges backward to a small box or frame, one foot square, with a slide cut-off (D). This box forms the mouth to a secondary bag (B), two and a half feet long and one foot in diameter, which ends in a second frame having two short runners below it. There is a sliding door (E) of wire gauze in the end frame, and the secondary bag is stretched by a couple of strips of leather connecting the two small frames. The machine is made to "take more land" by means of two right-angle triangular wings (C) about six feet long, that hinge to the upright ends of the large frame in such manner that the rectangle joins the upper corner of the frame. From the lower side of this wing are suspended a number of teeth or beaters, which, swinging loosely, drive the locusts inward. The machine is handled by means of two ropes hitched to the outer runners or to the outer and lower side of the mouth of the frame.

"On smooth ground the machine can be easily hauled by two men, but where the grass is tall and thick it pulls harder. The locusts, on hopping into the machine, soon reach the small back portion, enter the small bag, and are attracted to the rear end by the light which enters by the gauze door. When a sufficient number are thus captured the machine is stopped, the cut-off is slid down in front of the secondary bag, a hole is dug behind the machine, the bag tipped into it, and the insects buried. A strip of leather closes the slit through which the cut-off slips, and the main bag is made of dark cloth, while the secondary bag is white, so as by contrast to attract more thoroughly the locusts.

"The advantages of this machine are that it requires no additional expense to run it, as for oil, tar, &c. It will catch the winged locust as well as the young, if operated on cool mornings and evenings, and is adapted to almost all conditions of growing grain. The machine can be made for about $10, and perhaps less."

"In practice we found it best to draw the machine by hitching to the runners, and to brace the wings at desired angles, according to the strength of the wind, by means of two iron rods, as in the illustration."

Protection of vegetable gardens.—On the New Hampshire farms it becomes necessary to devise some remedy for use in the vegetable gardens where the machines just described, and which are for field use, cannot be advantageously operated. Here the kerosene emulsion which we have so frequently recommended of late again comes into play. An emulsion resembling butter can be produced in a few minutes by churning with a force pump two parts of kerosene and one part of sour milk in a pail. The liquids should be at about blood heat. This emulsion may be diluted with twelve parts of water to one part of emulsion, thoroughly mixed, and may be applied with the force-pump, a spray-nozzle, or with a strong garden-syringe. The liquid will kill all locusts which it touches without harming the vegetables.

An equally good emulsion may be made as follows:

Kerosene ...... 2 gallons $= 66\frac{2}{3}$ per cent.
Common soap .. $\frac{1}{2}$ pound } $= 33\frac{1}{3}$ per cent.
Water .... 1 gallon }

Heat the mixture of soap and water and add it boiling hot to the kerosene. Churn the mixture by means of a force-pump and spray-nozzle for five or ten minutes. The emulsion, if perfect, forms a cream, which thickens on cooling, and adheres without oiliness to the surface of the glass. Dilute with cold water before using, to the extent which experience will indicate is best, and which will differ according to the plants to be sprayed or to the size of the locusts to be killed.

Necessity for co-operation.—The necessity for united effort in dealing with this pest is obvious, and, in closing, we quote the words of Mr. J. K. Chandler, whom we have to thank most sincerely for his kind hospitality in the pursuance of this investigation:

With a common purpose and determination to rid our beautiful intervale of this pest, which requires but an united effort to overcome it, it is absolutely certain that the intelligent farmers of the Merrimac Valley will command success.

REPORT OF SUPERINTENDENT OF GARDENS AND GROUNDS.

SIR: I have the honor to submit the following notes on matters appertaining to this division:

The portion of the Department grounds available for cultivation is gradually being reduced, owing to the space required for the extension of buildings rendered necessary by the progress and increase of departmental work. The cultivated ground is now reduced to several small tracts, aggregating but little over two acres, and about one-half of this is employed in hardy grapes, strawberries, raspberries, &c., planted with a view of testing the merits of new varieties as they appear. This, however, may be abandoned; the exposed condition of the grounds since the removal of the fences, and their proximity to the city, renders it impracticable to protect fruits from being pilfered or destroyed before they ripen, so that comparative tests cannot be obtained. Another evil consequent upon insufficient protection is the depredations of animals, especially dogs, which during their nightly visits displace and scatter labels, break plants, and commit havoc which cannot be repaired. Under these conditions it is not possible to preserve accuracy in the names of plants or cuttings, except those which are kept constantly under glass.

The propagation of economic plants is prosecuted as far as means and opportunities will admit. Particular attention is given to a few species which are in much demand for trial in semi-tropical regions, and of which the supply is always very inadequate as compared with the applications for them. Requests are received almost daily for olives, bananas, *cinchona*, coffee, tea, oranges, lemons, dates, figs, and many other plants which it is supposed will prove adapted to the warmer portions of the Southern and Western States. As most of these plants have to be propagated and grown in glass structures here, they can only be furnished in meager quantities; therefore the suggestion constantly presents itself, and may be repeated, that the purposes of the Department, so far as relates to the introduction, propagation, and distribution of semi-tropical vegetable products, cannot be fully realized until means are taken to cultivate these plants in climates where no protection is required, and where they can receive such treatment as to render them fit for field culture. It is well known that plants which have been grown in pots for several years seldom form good, long-lived plants when transferred from pots to the orchard. The roots are twisted and curled in the pots, and will in most cases continue a twisting form as long the plant exists. In this view of the case, many of the plants, such as orange trees, which have been raised here and sent by the Department, are only useful so far as to afford buds for propagation. As orchard trees they will fail in a short time.

CULTURAL REMARKS.

GRAPES.

In the earlier annual reports of the Department of Agriculture considerable space was given to the native grape, its diseases, best localities for its growth, the value of different species, and the varieties which had been obtained from them, and such other questions as were at that time deemed important. Previous to the time alluded to, comparatively but little was known relative to diseases of the grape. The leaves dropped from the vine in midsummer, and the berries rotted before ripening; the cause of the former was attributed to sun-scald, and the latter to wet and undrained soil, neither being strictly correct. Recent microscopical investigations have confirmed the accuracy of suggestions which attributed these diseases to fungoid growths, but the predisposing causes which render fungoid growths possible have not in all cases been fully determined.

The origin of many of the diseases of plants is obscure, and in attempts made to trace them we find opinions conflicting to a degree apparently irreconcilable. This may arise partly from the accommodating nature of plants, together with the diversity of the modifications of the various agents by which their growth is influenced, which renders it extremely improbable that any single observation can be universally correct. There is scarcely any natural phenomena which may not be explained in various ways, according as they are traced to their primary, secondary, intermediate, or proximate causes, and, as far as it goes, each explanation may be equally correct. This explanatory latitude, however, is a source of much perplexity to the uninitiated, who cannot perceive the possible relations they may maintain with some fundamental or primary principle. The fundamental principles in the economy of vegetable growth are comparatively few; at the same time their combined actions lead to extensively varied results, so that it is of absolute necessity that observations should be minute and exactly recorded, and their authenticity associated with a clear perception of their influences, before we can arrive at a decision of their true value with reference to any phenomena which may excite our attention. In the absence of such caution we may not expect to reach true conclusions, and we here see the origin of the numerous opinions that are constantly promulgated in relation to the diseases of plants, and which are valuable or otherwise according to the discriminating knowledge possessed by those whose opinion is offered.

Notwithstanding all that has been said and written on the subject of mildew on grape leaves, it is still imperfectly understood by the majority of those most interested in the culture of the grape. It is well known that in some localities many of the best varieties do not succeed solely on account of their foliage being destroyed more or less by mildew, and the criterion of a useful grape depends solely upon its freedom from mildew on the leaves, and not on account of the flavor or other good qualities of the fruit; so we find that the most popular varieties are not those of the highest merit in flavor, but those that are least affected with mildew on the foliage and fruit. The most prevalent form of mildew on the leaves of our native grapes is known as *Peronospora viticola*. This is always found on the under surface of the leaf; it commences in small spots of a brownish color which adhere closely to the leaf ribs, and when the conditions are favorable it spreads rapidly and destroys the vitality

of the part attacked. Its presence is made apparent by a yellowish tinge which may be seen on the upper surface of the foliage, and in clear weather these spots become brown-colored, afterwards crisp and dry, and ultimately the leaf is more or less destroyed. This appearance on the foliage is sometimes termed sun-scald, but it hardly need be stated that the leaves would not be injured by the sun were it not that their vitality is impaired by mildew; yet we frequently meet with cultivators who maintain that their vines are free from mildew, while they admit the foliage is scalded by the sun and dying off. By the time its effects are thus visible the mildew is not so easily discerned, or it may have run its course and left but little evidence of its presence in an active state, and this may be the reason why many grape-growers show so little knowledge of the disease. Hence the origin of so many seemingly conflicting opinions relative to the exemption of varieties of grape from mildew, owing to the effects produced by this disease being attributed to other supposed causes.

It is a disputed question whether or not mildew will attack perfectly healthy vegetation. By many persons it is held that fungoid growths only appear on disorganized vegetable or animal matters; that, previous to the appearance of the mildew on leaves, some disturbing cause has been at work on the plant, and the partial decomposition which has resulted from the unhealthy state forms proper conditions for the development of the fungus. From this reasoning it follows that, previous to the appearance of mildew, there must exist a disorganization of vegetable tissue, and before a remedy can be suggested we must first endeavor to discover the cause of the incipient disease which allows the development of the fungoid growths.

The *Peronospora* is never found on grape-leaves which are always dry. The predisposing cause of this particular species of fungi is an excess of retained moisture on the foliage, either from continued wet and damp weather, or from heavy night dews succeeded by calm days. Grapes trained on trellises protected by a covering at top, so as to prevent the radiation of heat from, and the consequent deposition of dew upon, the surfaces of the leaves, are never troubled by this fungus. It is also a common observation that grape-vines growing through and over trees are never seriously injured by mildew, the protection afforded by the leaves of the tree preventing it. Branches from the same root, some of which are allowed to ramble over a tree, and others trained upon an ordinary trellis, will afford a good example as to the benefits of protection in preventing mildew. Hence it may be inferred that a good locality for vineyards is one where there is exemption from late spring frosts, from heavy dews during summer nights, and from early frosts in autumn; and the best results will be found where all these conditions exist, and failures will follow in proportion to their deficiency.

So far as concerns entire freedom from the mildew under consideration, the conditions are found on sloping hillsides contiguous to well-defined valleys. It has long been observed that in clear, still nights during summer, dews are less frequent upon the sides of hills than they are in the neighboring valleys. The appearance of hoar-frost in valleys during the early winter and spring seasons is produced by conditions of temperature similar to those which cause the heavier deposition of dews in these localities. During clear nights currents of cool air run downwards on the inclined lands to the bottom of the valleys. These currents are the result of the sudden depression of temperature sustained by the surface of the earth, in consequence of rapid radiation, by which the stratum of air in immediate contact with that surface becomes spe-

cifically heavier by condensation, and descends into the valley, which then rapidly cools, while the warm air of the valley is lifted up, and impinges on the sides of the hills; and so far as this warm stratum extends there is no condensation of moisture such as occurs in the low grounds in the form of heavy dews in summer, and which in cool weather freezes and becomes hoar-frost. The effects of this stratum of warm air upon vegetation on hillsides is very well defined when early autumn frosts have destroyed the foliage of the trees below a certain line, which is sometimes called the vernal line, or line of no frost; above this line, and within the limits of the extent of the warm stratum or zone, vegetation is unharmed. The altitude to which this line reaches above the bottom of the valley is dependent upon the mean temperature of the day and night, or rather upon their comparative difference at the time of its occurrence; when the temperature of both are high, the lower places only are affected by the frost, but when low, the frost will extend higher up on the hills.

If we consider the climatic conditions of localities where grapes do well, we will find that they are those which are nearly exempt from dews, and, as a consequence, all varietes of grapes retain their foliage during summer. In other words, the distinguishing peculiarity of a good grape climate is that of the entire absence of mildew on the foliage of the grape, and this is entirely independent of cultural processes of manipulation or training, or of the quality of the soil in which they are planted, although the latter may sometimes exert an auxiliary influence.

In illustration of the conditions which constitute a good grape climate mention may be made of the hilly lands bordering Keuka Lake, in Steuben County, New York. These steep hillsides are covered with vineyards which extend for several hundred feet above the level of the lake; the soil is shaly, and in many places the surface is very thickly covered with loose stones. On these hillsides mildew is comparatively unknown, the Catawba, Iona, Delaware, and indeed all varieties of native grapes, except those which require a longer season than the climate affords, mature to a degree of perfection which they fail to attain in more southern but less favorably situated localities. The influence of the lake is also well illustrated in the freedom from mildew on the vines which are planted quite close to the water. Higher up the valley beyond the lake, while the vines are equally as healthy on the hills there as they are on those in the near neigborhood of the lake, the plants suffer from mildew on the lower grounds, showing that the radiation of heat from the water during night has the effect of preventing dews even on low grounds near the lake. Here we have two factors, both of which are favorble to a healthy conditon of vine, or rather they prevent mildew, which is the prime result, if not the cause of unhealthiness, so far as atmospheric influences are concerned. The first of these is owing to the elevation above the valley; during the day heat accumulates in the valley, and forms a strata of warm air, which is lifted up as the colder air rushes down the slopes after sundown, as previously stated, which forces up the heated lighter air, and wherever this warm air strikes upon the hillside dews are not found. This has been explained as follows:

Hoar-frost is but crystallized dew, and can only form during clear, still nights, when the atmosphere is in repose. The atmosphere, when at rest, falls into a series of strata, one lying above the other, the heaviest stratum becoming the base of those above it, and all taking positions according to their weight and density, upon the principle of gravitation. Heat is the agent that produces this result. The heat is of two kinds, both from the same source: the primary one being the sun's rays direct, and the other the heat reserved or retained by the earth. This heat is ever radiating,

and in cold, clear, still nights it mounts upward through the cold, damp air, taking from it its caloric, while the latter rushes down in a cold frost, producing currents, and hence the lowest ground in a valley is ever subject to the first and hardest frosts. The warm, dry, light current keeps mounting upward like cork in water, until it reaches a stratum of atmosphere too thin and light to support it, when it consequently falls back and forms its warm, dry, genial stratum upon the top of the lower or frost stratum; and hence in frosty nights of spring and fall is produced that phenomenon which is variably called the *vernal zone*, or *line of no frost*.

The line or zone is not uniform in its limits, as that depends upon the degree of cold which pertains during the night; also in some degree upon the configuration of the sloping surface of the hill. The height above sea-level has nothing to do with it; the local elevation alone determines the presence and extent of the phenomenon.

The second important factor is the influence of the water in effecting a healthy condition of local climate. The ameliorating influence of an extensive body of water is well understood, and a noted illustration of its value is found on the shores and on the islands of Lake Erie, which have long been popular for the extent and excellence of the vineyards and the superior qualities of the fruit which they produce. This success is fairly attributable to the modifying effect of the body of water upon the atmosphere, which secures a comparative immunity from heavy night dews during the season when vegetation is most active. The heat which the water accumulates during summer has the further effect of warding off the frosts of autumn and early winter, thus virtually lengthening the season to an equality with the climates of latitudes several degrees southward, so that grapes which ripen perfectly in the vicinity of the lake fail to mature in localities immediately beyond its influence.

It would seem as if grape-growers were slow to recognize the importance which should be attached to this question of suitable and unsuitable grape-growing localities. For all cultural purposes it is sufficiently accurate to assume that the hardiness of a grape simply depends upon its immunity from mildew. On the other hand, when a variety of our northern native grapes is said to be too tender for our winters, it simply means that it is so subject to mildew that the growths fail to ripen, as all of our native grapes of the Northern States, and indeed foreign grapes also, will stand the winters, provided their young yearly growths become thoroughly matured; the summer climate rather than the winter climate decides the question of hardiness, so that when a seedling grape is announced as being perfectly hardy and exempt from rot in the berry, it may be true as far as hardiness is concerned, in the climate where it originated, if it happened to be a specially good climate, but it does not follow that it would be hardy in other parts of the country, as hundreds who have purchased such plants can abundantly testify. As to freedom from rot, no one acquainted with grape-culture will guarantee any variety from rot in the berry.

It will not be out of place to mention the only other form of mildew that may sometimes be seen on grape-leaves. This is a species of *Erysiphe*, identical with the *Oidium* of Europe. This form appears on the upper surface of the leaves; it may also be seen on the surface of the fruit, its appearance being somewhat similar to a dusting of fine flour, and may be brushed off without leaving any apparent marks of injury, but its effects are to retard growth. Young green shoots once covered with this fungus cease to grow, and will remain green until the frosts of winter destroy them. When fruit becomes severely attacked it cracks open, and the seeds will protrude. Green shoots will also crack if the mildew attacks them severely. The same result may be observed in the

fruit of the European gooseberry; also it sometimes attacks pears, such as the White Doyenne, which are rendered useless. This cracking is only one result of the *Erysiphe*, and may not be peculiar to it. Other forms of mildew may lead to the same appearance. This species of mildew occurs on many kinds of plants. Unlike the *Peronospora*, it abounds mostly in the early part of the growing season. Sudden changes of the weather from heat to cold will produce it. It, or closely allied species, may be found on the leaves of the lilac, hawthorn, gooseberry, and many other plants. Garden peas have an *Erysiphe* which attacks them in the late summer; but our native grapes do not suffer materially at any time from this kind of mildew.

The disease called rot in the berry has not yet been traced to its definite cause. That the rot is produced by fungi does not greatly add to our resources of counteracting its effects. We have not yet ascertained the adverse conditions to health which make the appearance and spread of the fungus possible. Observation has shown that it is not confined to any particular kind or condition of soil; sandy soils, clay soils, wet soils, dry soils, are all seemingly alike so far as primary attacks are concerned. Neither does any system of pruning make the vines more or less subject to the disease, and it may be prevalent in all kinds of weather, wet or dry, warm or cool.

Evidence seems to accumulate showing that it is produced by atmospherical influences, and that it may be prevented by artificial coverings. The success of covering bunches of grapes in paper bags, and their pronounced freedom from rot when so protected, is strong proof as to the atmospheric origin of the malady. In fact, the conditions which render this disease possible seem to have a close resemblance to those which favor the growth of mildew on the foliage. It appears that all varieties of grapes are subject to be attacked, although not in the same degree. About ten years ago it was a very general opinion that young grape-vines were not likely to be affected by rot, and that two or three crops could certainly be expected before rot made its appearance. Now it is well known that even the first crop is just as likely to become diseased as those of older growths.

It is evident that we have not yet gathered enough facts connected with the grape-rot to warrant any attempt towards systematizing observations, which will have to be done before we can arrive at an intelligent conclusion as to its cause. Diseases of this nature are very often the result of causes which may have occurred months before their visible outbreak; therefore, it may happen that reports based upon conditions of soil and climate at the time of their greatest severity and when the destruction is most conspicuous, may not include the peculiar conditions which originate them. It has been surmised that grape-rot might be caused by *phylloxera* at the roots, but the connection is not a probable one.

The destruction of the foliage of our native grapes from mildew has, in some cases, been wrongly attributed to the ravages of the root-louse. It is comparatively a rare occurrence to meet with a vineyard composed of native grapes suffering from the root-louse to the extent of severely injuring the health of the plants or interfering with their ordinary weight of crop; but vines suffering to this extent present an appearance which could never be confounded with mildew by even an ordinary observer. Mildewed leaves have already been described, beginning with the small brown spots on the leaves which gradually extend until they finally become crisp and fall off. Next to a mildewed leaf may be found one green and healthy; and where a mass of foliage

exists, only the upper and more exposed portions of the foliage will suffer; but when vines are severely attacked by the *phylloxera* their appearance is very different from the above. A grapevine thus attacked presents a hard, yellow appearance, not unlike yellows on peach leaves; a closer examination shows that the growing points of the shoots are thickly studded with small yellow leaves; the internodes between the leaves are scarcely perceptible, so that the leaves are closely pressed on each other, and all of very diminutive size, giving the appearance of a yellow tuft on the extremity of each shoot. An examination of the roots of vines presenting such an appearance will reveal the *phylloxera* clustering and covering the entire surface of even the smallest rootlet.

It is possible that *phylloxera* may be found on the roots of our native grapes, although the plants show no symptoms of their presence, and unless the plant has its vitality reduced from other causes it will continue to grow and bear fruit; but if from any cause, such as heavy cropping, severe pruning, or loss of foliage by mildew, the plant becomes weakened, then the ravages of the *phylloxera* hastens the destruction of the plant, unless measures are taken to increase its vigor before it is too late.

THE POTATO-ROT.

The rot in potatoes is caused by a fungus which first appears on the foliage of the plant, where it may be seen in small brownish patches on the underside of the leaves, which, under favorable conditions, soon spread and attack the stems, and in time the fungus threads run down the stems and reach the tubers, causing their decay. This fungus is named *Peronospora infestans*, and is allied to the fungus which destroys the foliage of many varieties of our native grape-vines, and in all probability originates under similar conditions. On a recent examination of a field of potatoes which were badly rotting, it was found that the dense mass of leaves were spread so as to entirely cover the surface of the ground, and although it had not rained upon them for a week, and the weather had been very warm and clear, on lifting up the stems of the potatoes they were found to be damp and even wet underneath, with a great abundance of the *Peronospora* spreading throughout the mass. These are precisely the conditions under which the grape fungus (*Peronospora viticola*) is found most abundant, and furnishes a reason for the rot attacking potatoes on dry lands and in dry seasons. On level, low-lying land where there are recurring heavy dews during clear, still nights, potatoes of strong, rank growth of stem and leaf will have a portion at least of their surfaces almost constantly wet, and thus the fungus gains a foothold and spreads rapidly or otherwise as the conditions for its growth exist. Taking this view of the development of the *Peronospora*, we would expect to find it less frequent on hillsides above the region of heavy dews, or in other localities which have been found favorable to the healthy growth of all varieties of native grapes. In any position, well-drained lands, or soils containing gravel, sand, and those of shaly formation, would be better adapted than moist lands. In dry soils some advantage would accrue from their absorption of sun-heat during the day, which would, in a measure, prevent the lodgment of dew. And, again, by planting in hills or drills wider apart than usual, a free circulation of air would be admitted on all sides of the plants, which would tend to keep them dry and lessen the tendency to mildew.

It is questionable whether any application to the soil in the way of special fertilizers will be of any value; so far, all experiments with ma-

nures to prevent rot have ended in disappointment; at least they have not led to any definite useful result. This may be expected if the above view of the subject is correct, since the kind of soil in which a plant is growing exercises but little, if any, influence on diseases which are solely dependent upon atmospheric influences.

SITUATIONS FOR ORCHARDS.

From the circumstance that fruit orchards which are situated in valleys, and in low, sheltered places, are not so healthy and prolific, and are more liable to injury from changes of temperature than those set in more elevated and exposed positions, it has been argued that all kinds of protection and shelter to fruit trees should be condemned as injurious, and that the coldest and bleakest positions on northern slopes are greatly to be preferred for fruits. This is probably going from one extreme to another. It is conceded that one of the very worst situations for a fruit orchard is in the rich lands of a contracted, sheltered valley, for in such a position the trees are subjected to great extremes of temperature; a difference of twenty degrees is not uncommon between the temperature of a valley and that of a point on the hillside sixty feet above it, during periods of severe frosts. It is very evident that such a site would be of the worst selection, and, so far as topography is concerned, the elevated northern exposure would be greatly preferable; but, a sufficiently elevated site once selected, it does not follow that it should not be judiciously sheltered, locally, from the exhausting effects of arid or cold winds. The benefits of local shelter are well known, and should not be confounded with the evils which follow a bad selection as above stated.

GLAZING GREENHOUSE ROOFS.

The ordinary method of fastening glass in window-sashes is to lay in the glass without a putty bedding, secure it with small triangular bits of tin, then complete the operation by filling the outside of the sash-bar with putty, lapping it slightly over the glass. When this method is applied to greenhouse roofs it causes a great amount of trouble to prevent leakage. The presence of moisture, which is almost always to be found on the inside of the roof during cold weather, and the action of frosts and rains on the outside, has a tendency to loosen and destroy the putty, so that an annual overhauling is necessary to keep it in repair. But there are now very few green houses glazed in the above manner. The old plan has given place to a more permanent and more effectual system so far as regards a tight roof. This plan consists in placing a layer of the best putty on the sash-bar, then pressing the pane of glass until it reaches a firm, uniform bed, and so working up a portion of the putty that it will fill all spaces between the edge of the glass and the sash-bar. After the surplus putty is trimmed off, it is allowed to dry for a day or two, which will cause it to shrink slightly from the wood, then a coat of thickish paint is applied, which effectually fills up all crevices, and makes a perfectly water-tight finish. No putty is used on the outside, and consequently there is no leakage from its decay; and instead of tin fastenings the glass is secured by brad-nails three-fourths of an inch in length, four to each pane, fastened at the corners.

The popular method of roofing glass structures is what is known as the fixed-bar plan. In this plan no framed sashes are used; the rafters are placed about eight feet apart, their exact distance depending upon the

size of the glass, so that, for a neat job, the glass bar will come in the center of the rafter. Between the rafters horizontal purlines are inserted to support the sash-bars. The sash-bars are usually made an inch and a half in depth and one inch in width; these are fastened in parallel lines, their distance apart depending upon the size of the glass employed; after testing various-sized panes, the size 10 inches by 12 inches is generally preferred. For this size the sash-bars are placed 12½ inches apart, measuring from their centers, allowing one-fourth inch rebate for the glass to rest upon on each side. In setting panes of this size it is of some importance to place the concave surface uppermost, which makes the center of the pane the lowest point, so that the water which falls on the roof will be diverted from the sides to the center of the line of glass. The glass should not lap more than one-sixteenth of an inch; wide laps hold dust, which in turn holds water, which may freeze in very cold weather and split the glass. The method of glazing admits of laying roofs nearly flat without trouble from leakage. Ventilation is provided for by hinged sashes on the roof, which may be arranged in various ways to prevent them from leaking; the amount of ventilating space allowed will have some dependence upon the purposes to which the structure will be devoted.

RASPBERRY CULTURE.

Within a few years back a notable change has been introduced in the general management of the raspberry. The only pruning formerly given to this plant was confined to cutting out the old stems which had fruited, thinning out the young stems which were to produce the next crop, and shortening them by cutting off a portion of their tops. These would then be fastened to a stake or some similar support, and this completed the pruning for the season. But the more modern system obviates the necessity of any kind of support, and the plants are managed so that they are able to support themselves when full of fruit. This is accomplished by allowing the first year's growth of newly set out plants to grow undisturbed; the second year two or more shoots will be produced, and when these have reached to a height of about two feet their tops are pinched off so as to stop their further upright growth; they will then proceed to push out side shoots or laterals on all sides, balancing and supporting themselves very effectually, and appearing like small evenly-headed trees. When growth has been completed for the season and the leaves have fallen, these side shoots are pruned back so as to leave them from 12 to 16 inches in length, according to their strength. This pruning can be done quite rapidly with pruning shears. At the same time, if not before, all the old stems or canes which have fruited are also removed; but many cultivators prefer to remove these old stems immediately after the fruit has been gathered, claiming that by doing so the young canes have greater freedom of growth; also, that by promptly removing the old canes many kinds of insects which lodge in the old wood and have cocoons and nests upon it are thus destroyed by burning all the prunings as they are collected. This system is continued annually; no greater number of young shoots than is required are allowed to grow, all others being destroyed as they reach a few inches in height. The summer topping is attended to as previously stated, and the result of this routine treatment is a self-supporting plant and improved fruit.

ROOT-PRUNING TREES.

When fruit trees are planted in good soil or in gardens highly cultivated there will be a tendency to a luxuriant growth of branches and a meager crop of fruit. When these conditions exist the expedient of root-pruning to promote fruitfulness is often recommended and sometimes practiced. This operation consists in digging out a cicular trench or ditch at a distance of from three to six feet from the stem of the tree, according to its size and growth, cutting away all the roots, at least all of the larger ones, that may be encountered. The soil is then returned and the operation is completed. It is sometimes advised to fill up the trench with rich soil or compost, but this, it is very evident, will go far to render the operation futile, since a check to growth is aimed at. Again, it is frequently advised to perform this operation in spring, but this is certainly not the best season.

The object of root-pruning being to check the formation of wood buds, and to favor the production of fruit buds, the most effectual period of the year is just before the completion of the annual growth in fall, or rather towards the end of summer, so that a check at this time will have the effect to lessen the flow of sap, and thus favor the formation of flower buds instead of wood buds. This is not mere supposition, but has been found a direct practical result, and is in accordance with an oft-repeated and well-indorsed axiom in vegetable physiology, viz., "that whatever tends to make trees or plants produce an extra luxuriant growth diminishes their tendency to bear fruit; and, on the other hand, whatever tends to diminish this degree of luxuriance of leaf and branch, so long as it does not interfere with or injure the general health of the plant, is favorable to the production of flowers and fruit." The change from wood buds to fruit buds is most effectually influenced near the period of ripening of the annual growth.

Root-pruning may also be successfully applied to plants that are apt to be destroyed when in luxuriant growth by winter frosts. Many Asiatic evergreens are thus affected; these are prone to a late growth in our genial autumn weather, and are liable to injury from even slight frosts; but when further growth for the season is checked by root-pruning in August or September, they will stand severe cold without injury. Young trees which thus suffer from frost will be hardened, and as they attain age will increase in hardihood.

KEEPING HEDGES.

One of the principal objections urged against the employment of live fences, or hedges, is the cost of keeping them in efficient repair, for it admits of no qualification that unless they receive proper attention they will prove to be of but little value as a fence against live stock. Unfortunately, our best hedge-plants, so far, are of strong growth, especially when young, and consequently require to be trimmed two or three times during summer, at least for several years after planting, and this at a time when farm crops demand attention, so that in a vast number of cases the hedge is neglected and soon ceases to be serviceable. The best hedge-plant is one that could be kept by winter trimming only, because in that season of comparative leisure it would probably receive attention, but with such strong-growing plants as the Osage Orange and Honey Locust, our two popular hedge-plants, it is impracticable to produce a close fence without frequent summer trimmings. There is one thing, however, which should be put to their credit, that,

after a few years, the growths will be less profuse; the weakening effect of continued summer pruning ultimately weakens the plants, so that they become easier managed. This also prevents them from sending out their roots to a great distance, so that they do not interfere with cultivated crops, an evil which soon becomes visible when a hedge is neglected and allowed to take care of itself. When a hedge gets into a condition that one summer trimming and one winter trimming will keep it in fairly good condition, the labor and cost is reduced to a minimum. It will also have a tendency to retard the exuberance of early summer growth, if the winter trimming is delayed until after the buds begin to push in spring. This will make a difference of several weeks in regard to summer trimming, and will prove of some importance when summer pruning is confined to one operation.

The weakest part of a hedge is always nearest the ground; the criterion of a well-kept hedge is that of thickness at the bottom; this should also be its widest part, and it should taper upwards to a point. Unless this form is strictly maintained the lower branches will gradually weaken and ultimately die out, leaving gaps which are not easily closed. Hedges which become weak and full of gaps through neglect may be renewed by cutting them down early in winter to within eighteen inches or so from the ground; the plants will then branch out vigorously, and, by proper pruning, soon be all that need be desired as a fence.

MAKING AND KEEPING LAWNS.

To have a perfect lawn it is absolutely necessary to have it properly laid down to begin with. The primary requisite is the proper preparation of the ground. There is nothing that can be done to soil with the view of making it productive and in the best condition for plant-growth that is not necessary to be done to soil intended to support a permanent green lawn. Draining, deep-working, manuring, and thorough pulverization are all requisites to the best degree of success. In preparing a lawn of any great size, where it is practicable to use a plow, the work should be done with exact thoroughness. It will in all cases be best to work the ground in autumn if it is of a clayey character. It should be turned over as deeply as practicable, and a subsoil plow shouldfollow in each furrow, breaking up but not turning over the subsoil, nor bringing any of it to the surface. Subsoiling is often so slovenly performed that it is of but little benefit, but it is of so much importance that special care should be given to its proper execution, so that it be something more than a mere scratching of the ground. In the immediate preparation of the surface previous to seeding in spring, the ground should again be plowed over so as to turn under any of the poorer portions of subsoil which may have been brought to the surface by the previous deep plowing. This is very important where the subsoil is at all of a clayey, adhesive nature, as a surface soil of this character prevents the uniform growth of the young grass-plants, and becomes hard and compact on the surface, destroying the grass even after it has vegetated. Previous to this shallow plowing a dressing of barnyard manure should be spread on the surface and covered. This may be substituted by an application of bone fertilizer of not less than 500 pounds to the acre, harrowed in just before sowing. After sowing, a light harrow should be run over it, followed by a roller to press the seed into the soil, but no rolling should be given to clayey land unless it is thoroughly surface-dry at the time.

The one best grass for a permanent lawn is the blue grass, *Poa pratensis*, and under favorable conditions of soil and weather no addition

is needed. But the seed of this grass is rather slow to vegetate and if the surface becomes hard and compact before the young plants make their appearance there will be much loss. The best general mixture, after various trials with other kinds and mixtures of grasses, is to mix two bushels of blue grass, one bushel of red-top, *Agrostis vulgaris*, and one quart timothy, *Phleum pratense*, for one acre. This is a heavy seeding, but experiments show that there is a gain in rapidly securing a thick sod by seeding thus heavily. Some prefer to add about one pound of white clover to the above, which may assist in forming a dense lawn, but the best lawns are those in which white clover is not to be found. The practice of sowing oats, barley, or other grains with the grass seeds, under the impression that these latter plants will protect and foster the young grass-plants from sun and drought, is altogether wrong and ruinous to a young lawn. It may be asserted that no good lawn was ever produced in one year where grain crops are sown with the grasses. Yet the practice is continued, and continued disappointments follow. When the mixtures of grasses just given is sown in a proper manner about the early part of spring, the grass will be ready for the lawn-mower by the middle of June; after two or three weekly cuttings the lawn will have the thickness and appearance of an old sod. But when oats are sown, they will be cut over once or twice until their stubble dies, and what few weak grass-plants have struggled into existence will succumb to a week of dry-sunny weather; then weeds take the place of grass, and the lawn will have to be renewed by additional sowings. While it is true that a good lawn cannot be produced unless everything has been properly prepared, it is equally true that a good lawn cannot be maintained without proper attention to mowing and fertilizing. Lawn-mowing machines are now so cheap and efficient that the cutting of a lawn is merely a mechanical operation, and one requiring but little skill in its performance, and the numerous fine lawns now everywhere to be seen are, in a great degree, due to the introduction of these machines.

When a lawn becomes thin and the growth of the grasses declining in vigor, the best treatment is to apply a heavy dressing of well-rotted stable manure during the latter part of December. It is important that manure for this purpose should be well rotted before being used, and as occasion offers during winter it should be broken up and harrowed or raked, so as to distribute it equally over the surface and settle down and nourish the grass. When spring opens, all the rough and strawy portions should be removed; otherwise it will interfere with the action of the mower.

Bone-meal is one of the best applications that can be given to a lawn. The practice of allowing the cuttings from the mowing-machine to remain on the lawn is, upon the whole, very injurious. With newly-formed lawns it is of some value for one or two cuttings; after that it tends to injury.

MANAGEMENT OF ORCHARDS.

Whether the land occupied by orchards of fruit trees should be plowed and cultivated, or sown in clover or grass and remain undisturbed, is still a frequent subject of inquiry in the correspondence of the Department. The object in planting fruit trees, it is hardly necessary to state, is to produce fruit, and that course of general treatment which best maintains the trees in a healthy state of growth, and at the same time keeps them in a condition of productiveness, may be considered as being good, whether the treatment involves the plowing and cultivation of the

soil, or whether these good results are attained by sowing the orchard in grass and keeping the surface covered with sod. It is well known that eminently productive and profitable orchards can be shown under both of the above systems of management, for the time being. Cultivation or non-cultivation are simply expedients to be adopted in gaining certain wished-for results; the primary mistake is to attempt to turn either expedient into a fixed and unchangeable system.

It is understood that the processes generally included in the term "cultivation," such as plowing, harrowing, &c., are all favorable to the encouragement of growth in plants, and when applied to fruit trees, the usual result of increased vigor will be produced. But it is also well understood that the greatest vigor of growth is not always combined with the greatest productiveness of fruit; on the contrary, it is a recognized fact that a tree cannot display unusually great vigor of growth and at the same time be correspondingly fruitful. On the other hand, it is common knowledge that trees growing in poor soil, and without receiving cultivation of any kind, will not long continue to maintain sufficient vitality to enable them to produce perfect fruit, nor, indeed, fruit of any quality. These extremes of poverty and luxuriance are similar, inasmuch as neither condition is the best for the production of fruit, and therefore the efforts of the fruit-grower should constantly be directed towards a medium between these extremes. When young trees are planted in ordinary good soil, and afterwards receive good care, so far as cultivating, stirring, and manuring the soil is concerned, they usually make strong growths. It is well to encourage this luxuriance at this stage of their existence; the only precaution being to guard against an immature condition of wood when frosts occur. Mistakes are sometimes made, in climates where the season of active growth is comparatively short, in stimulating the plants to such a degree that the wood fails to ripen thoroughly and the young shoots are destroyed by frosts while in an immature state, giving rise to various diseases, such as yellows in the peach, &c. When the trees reach a fruit-bearing size, but give no evidence of a fruit-bearing disposition, it may be assumed that their barrenness is owing to excessive growth, and it will therefore be in order to adopt some means of checking the growth, and, as a consequence, induce the trees to bear fruit. Various measures may be pursued to effect this object, but perhaps there is none so simple and so easily applied as that of laying the orchard in grass. The absence of all culture will speedily cause the formation of fruit buds and satisfactory crops of fruit, and so long as this continues no change need be made; but if the trees become weak, from overbearing, or from want of nourishment, top dressings of manure will again renew their vigor; and, further, if the trees appear to be stunted and do not respond to surface stimulants, the grass may be plowed under and a system of thorough culture inaugurated and kept up so long as observation determines that it is the best practice to follow.

The condition of the trees will therefore be the best evidence as to whether the orchard should be cultivated or kept in grass. Each orchard will answer the question for itself. It is not a question as to the advisability of establishing a system based upon either expedient, although it is usually and erroneously submitted in that shape.

ON DRAINING LANDS.

The statement is sometimes made that draining is but of little use in a climate where hot suns and dry weather are so common; that instead

of trying to get rid of water we should rather try to retain it; but those who reason in this way do not seem to be aware that the purpose served by draining land is the removal of superfluous water only, and not that of extracting all the available moisture which it contains. Every variety of soil has its relative degree of porosity or power of retaining moisture. Peaty or mossy soils, which are mainly composed of organic matter in different stages of decomposition, are very porous, and in consequence absorb water readily and in great quantities. Clay soils, on the other hand, being close and compact, absorb water slowly and to a limited degree as compared with the first mentioned. Draining a peaty soil will not deprive it of porosity; it may be likened to a sponge, which will retain all the water which may be poured on it until its pores become filled; afterwards the water will drop from it as fast as it is poured on. So it is with draining soil; no water will escape by the drains until the soil is saturated and is unable to contain any more, then the superfluous water passes off by the drains, leaving the land always in a condition for healthy plant-growth, which is completely reversed when the superfluous water is only removed by the slow and chilling process of surface evaporation.

Clay soils cannot be cropped to their best advantage until they are drained. The ordinary operation of plowing has a tendency to form a hard surface at the bottom of the furrows, which in time becomes compacted and acts as a basin in holding water. Soils of this kind are well designated as cold. The heat of the sun cannot warm the soil until the water is first removed by evaporation, a process which produces cold; so that, in addition to the impracticability of putting in crops early in spring, every heavy summer-rain cools the earth, and the plants growing in it receive a series of checks in their progress towards maturity. Draining removes all these evil consequences.

Briefly, it may be stated that some of the advantages of draining are the removal of superfluous water from the soil, thus keeping the temperature of the earth near the surface at its normal state. This makes early planting possible, and hastens the growth of crops; it equalizes the temperature of the land; it equalizes the moisture of the soil, and growing plants are thus, to a great degree, exempted from the evils which follow either deficiency or excess of rainfall; the roots of plants are more generously supplied with soluble food carried down by rains; the formation of plant-food is increased by the admission of air to the soil; the land is more economically worked, and cultivation suffers less interruption at all seasons, and, as a consequence, crops are increased to their maximum production, at least so far as they are dependent upon the physical condition of the soil, a factor of equal importance with that of its chemical constitution, and one which is greatly underestimated.

FLOWER-POTS.

The relative value of hard-burned and soft or porous flower-pots, so far as the culture of plants is concerned, is a subject of occasional inquiry. Hard-burned pots are not generally esteemed, and many persons consider them unfit for the best results of plant-culture, while others find no objection to them, and use indiscriminately glazed pots or even slate tubs when they can be procured. The only difference seems to be that the porous pot will require more water than will be found necessary in the case of hard-burned pots or slate tubs. The porous pot will part with much water by evaporation from its sides, especially when exposed to the sun or a dry atmosphere. In a dry atmosphere the hard,

close-grained pot will retain more moisture in the soil. Plants, therefore, require water less frequently in the hard pots; and in the ordinary green-house, where a considerable amount of humidity generally prevails, special care will be required in order that water is not given in excess. The same amount of water applied to plants of similar size and vigor, some of which are in hard and others in soft pots, will speedily show unhealthiness in those in the hard pots. It is perfectly practicable to grow plants equally well either in soft or in hard pots, but the details of management are different, and to those who are not experts in plant-culture the porous pot will be most suitable.

SEED SAVING.

Whether it is best for farmers and gardeners to save their own seed or make yearly purchases, depends very much upon circumstances, or rather upon the particular kind of seeds in question and the manner of saving them. Seed raising is a business which requires skill in culture and great discriminating knowledge, which can only be acquired by observant practice. As a general rule it is cheaper, in the long run, to buy seeds than to attempt to save them; this remark applies with greater force to the seeds of improved varieties than to species which are reproduced with more certainty from seeds. It is one of the great arts in seed raising to keep varieties true to their descriptive peculiarities, and with some kinds of seeds this requires an amount of attention and labor of which the majority of those who purchase seeds have but a faint conception. As an example, we will specify the cabbage; and in the first place we would remark that it is now held that cabbage seed raised near the sea coast is always better than that raised inland; so confident of this are the market gardeners around New York, that they endeavor to procure their early cabbage seed from growers on the eastern Atlantic side of Long Island. The seed raiser is, as a matter of course, very careful as to the seeds he sows for his cabbage crop; but in order that any variety should be maintained as near to its perfection as possible, the crop is carefully inspected after the plants have headed, and all those that do not come up to the perfect standard in regard to compactness, size, shape, and time of heading, are destroyed, and only those which pass inspection are retained. The seed dealer who acquires a reputation for care and accuracy in this matter can sell his seed at highly remunerative prices, which may be double the amount asked by others for the same variety, but which has been carelessly and indiscriminately saved. Varieties must always be grown very widely apart for seed, for so far as bees can fly there is danger of crossing with other and inferior kinds. Of course any farmer or gardener who uses the same precautions can have similar results, but where the attempt is made to grow several varieties in one field the distinctive characteristics of each variety cannot be maintained.

Climates have also much to do in the matter of seed saving. When seeds are grown in a climate unsuited to their best maturity, they will perpetuate a weak progeny. For example, the oat plant requires a cool, moist climate for its perfect development; hence, seed oats grown in a warm, dry climate are very inferior. In countries suited to the plant it is not difficult to find seed that will weigh 45 pounds and more per bushel. Yet these heavy seeds if sown in the middle States will rapidly deteriorate; no matter how carefully crops may be managed, an annual shortage will be found both in the quantity and quality. In cases of this kind it is the best economy to procure seeds from the best localities, for no efforts towards acclimation will prove of any value.

But in climates entirely suited to the growth and full development of a plant it is possible to gradually improve its qualities by carefully selecting seeds from the most perfect plants only, and this is within the reach of every person who desires to save their own seeds.

Then the question of cost may be considered. Those who make a business of growing seeds can do so much more advantageously in most cases than the amateur in this line. We know that there is often much complaint about bad seeds, but in most instances these complaints have originated through bad management in sowing. The most common mistakes are those of covering the seeds too deeply with soil, and negligence in firming the surface after the seeds are sown; rolling the surface after seeding is one of the most important points in seeding.

Respectfully submitted.

WILLIAM SAUNDERS,

Horticulturist, Pomologist, Landscape Gardener, and Supt. of Gardens and Grounds.

Hon. GEO. B. LORING,

Commissioner.

REPORT OF THE CHEMIST.

SIR: During the past year the time of this Division has been largely spent in the investigation of sorghum, the results of which have been already published in a special report of the Department by Dr. Peter Collier. The remaining work, under my direction, has embraced the following subjects:

An investigation of the composition of American wheat and corn, with special reference to the effects of environment.

Analyses of flours and breads.

Analyses at intervals in their growth of vegetables, grown in the garden of the Department.

Analyses of fruits and vegetables, purchased in the markets of Washington.

Analyses of grasses.

Analysis of *Dasylirion Texanum* or Lotol, a Texan forage plant.

Analyses of many marls and other mineral deposits of agricultural interest.

In addition, much work of a minor nature, but of general interest, has been accomplished, and is chronicled in this report.

AMERICAN WHEAT AND CORN AND THEIR PRODUCTS.

During the past year the investigation of this subject has reached a point where the data obtained furnish a basis for some extremely interesting conclusions. The work in full has been published in the form of a special report, and such portions as have not previously appeared in our annual reports are here repeated.

WHEAT.

The specimens of wheat which have been analyzed number 260. They have been collected from all parts of the country, and represent fairly the average production of the various sections.

The results of the analyses are given in the following tables, together with such analyses by other investigators as I have been able to collect. They form a complete table of reference of all American wheats that have been investigated and with which we are acquainted:

Analyses of wheats from other sources than the Department of Agriculture.

No.	Name.	Locality.	Year.	Weight of 100 grains.	Water.	Ash.	Oil.	Carbhydrates.	Fiber.	Albuminoids.	Nitrogen.	Analyst.
				Grams.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	
1	White, Extra	Michigan	1877		12.75	1.56	1.26	70.96	1.83	11.64	1.87	Atwater.
2	Red	Missouri	1877		13.52	1.55	1.47	69.95	1.72	11.79	1.89	Do.
3	Diehl	Michigan	1876		9.64	1.72		76.26		12.38	1.98	Kedzie.
4	do	do	1876		12.18	1.82		72.22		13.78	2.20	Do.
5	do	do	1876		12.68	1.77		73.74		11.81	1.89	Do.
6	do	do	1876		10.25	1.50		76.37		11.88	1.90	Do.
7	Soules	do	1876		11.02	1.73		75.44		11.81	1.89	Do.
8	Soules British Columbia	British Columbia	1876		8.51	1.63		77.61		12.25	1.96	Do.
9	Soules do	do	1876		11.22	2.09		74.81		11.88	1.90	Do.
10	Soules do	Michigan	1876		10.07	1.89		74.59		13.45	2.16	Do.
11	Lincoln	do	1876		13.38	1.56		73.16		11.90	1.90	Do.
12	do	do	1876		10.78	1.75		76.09		11.38	1.82	Do.
13	Fultz	do	1876		11.45	1.74		75.22		11.59	1.86	Do.
14	do	do	1876		12.53	1.74		71.26		14.47	2.31	Do.
15	Treadwell	do	1876		12.69	1.71		73.10		12.50	2.00	Do.
16	do	do	1876		9.94	1.80		76.57		11.69	1.87	Do.
17	do	do	1876		10.00	1.76		76.36		11.88	1.90	Do.
18	Buckeye	do	1876		12.73	1.38		74.92		10.97	1.75	Do.
19	Tappahannock	do	1876		11.21	1.77		73.46		13.56	2.17	Do.
20	Lancaster	do	1876		11.93	1.82		72.25		14.00	2.24	Do.
21	Asiatic	do	1876		11.11	1.70		74.94		12.25	1.96	Do.
22	Gold Medal	do	1876		10.55	1.73		76.57		11.15	1.78	Do.
23	do	do	1876		10.12	2.00		74.82		13.00	2.08	Do.
24	Egyptian	do	1876		11.48	1.69		75.64		11.19	1.79	Do.
25	Clawson	do	1876		12.29	1.64		74.19		11.88	1.90	Do.
26	do	do	1876		11.30	1.74		76.02		10.94	1.75	Do.
27	do	do	1876		12.29	1.79		74.76		11.16	1.78	Do.
28	do	do	1876		10.36	1.64		76.19		11.81	1.89	Do.
29	do	do	1876		11.19	1.76		74.99		12.06	1.93	Do.
30	do	do	1876		11.09	1.64		74.89		12.38	1.98	Do.
31	do	do	1876		11.08	1.49		75.18		12.25	1.96	Do.
32	do	do	1876		10.43	1.70		75.18		12.69	2.03	Do.
33	do	do	1876		10.31	1.60		75.84		12.25	1.96	Do.
34	do	do	1876		13.00	1.79		73.84		11.37	1.82	Do.
35	do	Oregon	1876		12.99	1.77		74.74		10.50	1.68	Do.
36	Weeks	Michigan	1876		10.03	1.59		77.38		11.00	1.76	Do.
37	Powers	do	1876		10.85	1.70		75.42		12.03	1.92	Do.
38	Armstrong	do	1876		12.21	1.97		72.94		12.88	2.06	Do.
39	Tuscan	do	1876		13.77	1.72		73.14		11.37	1.82	Do.
40	Post	do	1876		10.27	1.58		76.90		11.25	1.78	Do.

41	Sonora Club	Oregon	1876	....	10.91	1.46		77.00		10.63	1.70	Do.
42	Minnesota No. 1	Minnesota	1882	2.732	12.34	1.59		70.98	2.03	13.06	2.09	Minn. Agri. College.
43	Minnesota No. 2	....do	1882	2.109	11.31	1.92		71.40	2.37	13.00	2.08	Do.
44	Minnesota No. 3	....do	1882	2.037	11.85	1.97		70.12	2.50	13.56	2.17	Do.
45	Unmanured	Pennsylvania	1882	....	13.33	2.04	1.99	69.02	2.76	10.86	1.74	Jordan.
46	$P_2O_5 + K_2O$	....do	1882	....	13.04	1.99	1.97	69.35	2.65	10.50	1.67	Do.
47	$P_2O_5 + K_2O + N_1$	....do	1882	....	13.16	2.03	1.90	69.24	2.51	11.16	1.78	Do.
48	$P_2O_5 - K_2O + N_2$	....do	1882	....	13.06	2.98	1.90	68.90	2.47	11.69	1.87	Do.
49	$P_2O_5 + K_2O + N_3$	....do	1882	....	12.59	1.83	1.92	69.53	2.53	11.70	1.88	Do.
50	Manure	....do	1882	....	12.41	2.09	1.89	70.10	2.37	11.04	1.76	Do.

ANALYSES OF AMERICAN WHEATS ARRANGED BY STATES.

Serial number.	Name.	Spring or winter.	Color.	Consistency.	Year of growth.	Weight of 100 grains.	Water.	Ash.	Oil.	Carbhydrates.	Fiber.	Albuminoids.	Nitrogen.	Analyst.
						Grams.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	
	CANADA:													
5	Victor	Winter	Yellow		1878	3.408	7.49	1.39	2.27	77.71	1.69	9.45	1.51	Department of Agriculture.
6	Silver Chaff	do			1878	3.686	8.93	1.58	2.44	75.41	1.75	9.89	1.58	Do.
11	Impr. Fife	Spring			1878		8.50	1.47	2.56	71.15	1.62	14.70	2.35	Do.
1358	Silver Chaff	Winter	Yellow		1879	3.597	11.05	1.90	2.28	73.27	1.70	9.80	1.57	Do.
1359	Midge Proof	do	White		1879	2.964	11.60	1.45	2.04	73.43	1.68	9.80	1.57	Do.
1360	Arnold Victor	do	Yellow		1879	2.972	10.90	1.60	2.14	72.23	1.58	11.55	1.85	Do.
	VERMONT:													
763	Cross	Winter	Yellow	Glassy	1881	4.073	10.87	1.75	2.04	72.13	2.52	10.69	1.71	Department of Agriculture.
	NEW YORK:													
12	Champlain	Spring			1878		8.79	2.05	2.55	69.72	1.49	15.40	2.46	Department of Agriculture.
13	Defiance	do			1878		8.12	1.57	2.49	71.78	2.04	14.00	2.24	Do.
767	Landreth	Winter		Soft	1882	4.541	11.43	2.10	2.02	71.85	1.75	10.85	1.74	Do.
	PENNSYLVANIA:													
.....	Unmanured	Winter			1882		13.33	2.04	1.99	69.02	2.76	10.86	1.74	Jordan.
.....	$P_2O_5 + K_2O$	do					13.04	1.99	1.97	69.85	2.65	10.50	1.67	Do.
.....	$P_2O_5 + K_2O + N$	do					13.16	2.03	1.90	69.24	2.51	11.16	1.78	Do.
.....	$P_2O_5 + K_2O + 2N$	do					13.06	2.98	1.90	67.90	2.47	11.69	1.87	Do.
.....	$P_2O_5 + K_2O + 3N$	do					12.59	1.83	1.92	69.53	2.53	11.70	1.88	Do.
.....	Manured	do					12.41	2.09	1.89	70.10	2.37	11.04	1.76	Do.
789	Champion Amber	do	Amber	Hard	1881	3.278	8.95	1.90	2.21	74.56	1.35	11.03	1.76	Department of Agriculture.
795	Lemon	do	Yellow	do	1881	3.417	8.35	1.90	2.51	70.13	1.53	15.58	2.49	Do.
797	Gold Medal	do	do	do	1881	3.076	8.60	1.80	2.37	76.05	1.38	9.80	1.57	Do.
799	German Amber	do	Amber	do	1881	2.938	7.60	1.70	2.64	75.98	1.05	11.03	1.76	Do.
803	Washington Glass	do	Yellow	do	1881	3.741	8.45	2.05	2.23	73.44	1.75	12.08	1.93	Do.
1280	Swamp	do	Red	do	1879	4.063	9.95	1.65	2.13	71.94	1.55	12.78	2.04	Do.
1282	Heiges Prolific	do	do	do	1879	3.097	10.00	1.15	1.77	75.07	1.33	10.68	1.71	Do.
1283	Glick	do	do	do	1879	3.958	11.55	1.80	2.10	70.50	1.80	12.25	1.96	Do.
1284	Champion Amber	do	do	do	1879	3.210	9.90	1.85	2.41	72.74	1.90	11.20	1.79	Do.
1285	Mediterranean White Chaff	do	do	do	1879	3.853	10,05	1.70	2.30	72.04	1.83	12.08	1.93	Do.
1286	Sandamika	do	do	do	1879	2.035	11.30	1.30	2.15	71.05	1.60	12.60	2.02	Do.
1287	Fultz	do	Amber	do	1879	3.275	11.40	.90	1.51	74.79	.90	10.50	1.68	Do.
1288	Gold Dust	do	Yellow	do	1879	2.526	11.45	.80	1.61	74.61	1.03	10.50	1.68	Do.
1289	Eureka	do	do	do	1879	3.238	10.50	1.35	2.14	72.86	1.60	11.55	1.85	Do.
1290	Washington Glass	do	do	do	1879	3.596	10.40	1.05	1.90	73.87	1.23	11.55	1.85	Do.
1291	Clawson	do	do	do	1879	3.120	10.60	1.60	2.09	72.10	2.23	11.38	1.82	Do.
1292	Gold Medal	do	do	do	1879	2.578	11.45	.90	1.39	74.60	.98	10.68	1.71	Do.
832	Mountain	do	White	Soft	1882	2.710	9.50	1.70	2.38	75.12	1.32	9.98	1.60	Do.
833	Mediterranean	do	Amber	Hard	1882	4.060	8.85	1.65	2.25	74.45	1.25	11.55	1.85	Do.

834	Fultz	....do	....do	....do	1882	3.020	9.55	1.80	2.30	75.20	1.70	9.45	1.51	Do.
1352	Fultz	....do	Red	Medium	1879	3.473	11.00	1.40	2.11	72.38	1.73	11.38	1.82	Do.
1354	Clawson	....do	Yellow	Hard	1879	4.292	11.35	1.90	1.90	71.90	1.75	11.20	1.79	Do.
764	Hybrid	....do	Amber	....do	1881	2.989	11.50	1.50	2.22	71.80	1.78	11.20	1.79	Do.
1831	Burkholder	....do	White	Soft	1883	4.658	10.78	1.93	1.92	73.53	1.69	10.15	1.62	Do.
1832	Pennsylvania Amber	....do	Amber	Medium	1883	3.641	10.72	1.98	1.91	72.06	1.95	11.38	1.82	Do.
1833	Fultz	....do	....do	....do	1883	3.882	11.45	1.97	1.46	69.61	1.86	13.65	2.18	Do.
	MARYLAND:													
9	Polish	Winter			1878	....	10.08	1.67	2.67	71.59	1.56	12.43	1.99	Department of Agriculture.
801	Rice	....do	Red	Hard	1881	3.586	8.40	2.15	2.32	70.97	1.63	14.53	2.32	Do.
783	Fultz	....do	Amber	....do	1882	3.198	11.06	1.85	1.98	73.43	1.70	9.98	1.60	Do.
809	Rice	....do	Red	....do	1882	3.075	10.00	1.80	2.18	71.91	1.86	12.25	1.96	Do.
1353	Centennial Amber	....do	Yellow	Medium	1879	5.079	11.05	2.05	2.11	71.03	1.68	12.08	1.93	Do.
1355	Midge Proof	....do	....do	Soft	1879	3.077	9.45	1.35	1.93	74.79	1.63	10.85	1.74	Do.
1821	Fultz	....do	Amber	Hard	1883	3.685	11.34	1.66	2.27	73.21	1.72	9.80	1.57	Do.
1822	Do	....do	....do	....do	1883	3.602	11.38	1.64	1.55	72.99	1.59	10.85	1.74	Do.
1834	White Mediterranean	....do	White	Soft	1883	3.492	11.92	1.63	1.77	70.30	2.30	12.08	1.93	Do.
	VIRGINIA:													
785	McGehee's Red	Winter	Red	Hard	1881	2.811	8.80	1.05	2.49	72.53	1.48	13.65	2.18	Department of Agriculture.
787	Finlay	....do	....do	....do	1881	3.285	9.45	1.60	2.38	73.67	1.18	11.72	1.88	Do.
766	Hybrid	....do	....do	....do	1882	3.652	11.54	1.65	2.00	70.30	1.73	12.78	2.04	Do.
780	Shenandoah 1	....do	....do	....do	1882	1.830	9.45	2.45	2.18	70.02	1.90	14.00	2.24	Do.
781	Shenandoah 2	....do	....do	....do	1882	2.655	11.15	1.60	2.56	72.76	1.78	10.15	1.62	Do.
782	Shenandoah 3	....do	....do	....do	1882	3.196	9.28	2.00	2.38	73.16	1.63	11.55	1.85	Do.
1361	Harrison	....do	....do	....do	1879	3.708	11.14	1.86	2.46	71.11	1.70	11.73	1.88	Do.
1842	McGehee's White	....do	White	Soft	1883	3.500	9.35	1.60	1.85	72.81	1.96	12.43	1.99	Do.
1844	Dallas	....do	Red	Medium	1883	4.137	12.26	1.58	1.83	69.59	1.96	12.78	2.04	Do.
1845	Fultz-Clawson	....do	....do	....do	1883	4.208	12.10	1.80	2.01	71.84	1.75	10.50	1.68	Do.
807	Wysor	....do			1881	3.796	9.25	1.55	2.16	72.71	1.73	12.60	2.02	Do.
	GEORGIA:													
791	Dallas	Winter	Amber	Hard	1881	4.023	7.95	2.15	2.48	73.17	1.65	12.60	2.02	Department of Agriculture.
793	Bennett	....do		....do	1881	3.218	8.05	2.05	2.22	72.30	1.38	14.00	2.24	Do.
769	Italian White	....do		....do	1882	4.627	11.22	1.70	2.68	73.47	1.48	9.45	1.51	Do.
770	Spring	Spring		....do	1882	2.946	10.92	1.80	2.40	71.55	2.13	11.20	1.79	Do.
765	Purple Straw	Winter	Red	....do	1882	4.512	10.49	2.30	2.12	73.46	1.48	10.15	1.62	Do.
1839	Red Mediterranean	....do	....do	....do	1883	2.894	9.19	2.04	2.13	72.18	2.03	12.43	1.99	Do.
1823	Do	....do	....do	....do	1883	2.834	12.20	1.66	2.09	69.57	1.88	12.60	2.02	Do.
	NORTH CAROLINA:													
811	Kivet	Winter	Yellow	Hard	1882	4.230	11.70	1.55	2.22	71.22	2.28	11.03	1.76	Department of Agriculture.
812	Do	....do	....do	....do	......	3.628	11.65	1.80	2.11	73.86	1.65	8.93	1.43	Do.
829	Do	....do	....do	....do	......	4.388	10.15	1.50	2.15	72.52	1.43	12.25	1.96	Do.
831	Do	....do	....do	....do	......	3.385	10.90	1.50	2.32	73.18	2.12	9.98	1.60	Do.
813	Rust Proof	....do	Red	Medium	1882	4.301	10.40	1.55	2.39	72.46	2.87	10.33	1.65	Do.
814	Do	....do	....do	....do	......	4.035	10.60	1.45	2.33	72.63	2.84	10.15	1.62	Do.
826	Do	....do	....do	....do	......	4.628	9.30	1.80	2.25	75.42	1.95	9.28	1.43	Do.
818	Baltimore	....do	Yellow	Medium	1882	3.906	9.55	1.60	2.28	75.05	1.54	9.98	1.60	Do.
819	Do	....do	....do	....do	......	3.433	9.85	1.45	2.32	74.08	1.10	11.20	1.79	Do.
820	Do	....do	....do	....do	......	3.925	9.65	1.65	2.25	76.35	1.00	9.10	1.46	Do.
821	Do	....do	....do	....do	......	3.330	9.20	1.85	2.06	75.14	1.60	10.15	1.62	Do.
828	Do	....do	....do	....do	......	4.155	9.70	1.65	2.16	73.48	1.63	11.38	1.82	Do.
824	Purple Straw	....do	Red	Hard	1882	3.236	9.40	1.70	2.47	74.58	1.70	10.15	1.62	Do.
825	Do	....do	....do	....do	1882	2.780	10.55	1.35	2.42	72.12	1.66	11.90	1.90	Do.

ANALYSES OF AMERICAN WHEATS ARRANGED BY STATES—Continued.

Serial number.	Name.	Spring or winter.	Color.	Consistency.	Year of growth.	Weight of 100 grains.	Water.	Ash.	Oil.	Carbhydrates.	Fiber.	Albuminoids.	Nitrogen.	Analyst.
	NORTH CAROLINA—Cont'd.					*Grains.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	
823	Davis	Winter	Red	Hard	1882	3.756	8.45	1.75	2.28	73.26	2.53	11.73	1.88	Department of Agriculture.
822	Do	...do	...do	...do	......	3.285	8.35	1.60	2.43	76.50	.44	10.68	1.71	Do.
830	Do	...do	...do	...do	......	3.702	11.05	1.55	2.31	70.85	1.81	12.43	1.99	Do.
815	Earnhardt	...do	Yellow	Soft	1882	3.951	10.92	1.30	2.10	74.07	1.63	9.98	1.60	Do.
816	Golden Premium	...do	...do	...do	1882	4.374	10.66	1.70	2.03	74.44	1.54	9.63	1.54	De.
817	Winter Green	...do	...do	...do	1882	3.567	9.40	1.20	2.34	76.17	1.44	9.45	1.51	Do.
827	Hick's Prolific	...do	Red	Hard	1882	3.419	8.15	1.85	2.20	76.64	1.53	9.63	1.54	Do.
1356	White Australian	...do	...do	Medium	1879	3.653	11.15	1.70	2.02	72.48	2.50	10.15	1.62	Do.
	ALABAMA:													
1801	Lancaster Red	Winter	Red	Medium	1883	3.930	11.18	2.37	1.64	70.70	1.51	12.60	2.02	Department of Agriculture.
1802	Smooth Mediterranean	...do	...do	...do	1883	3.955	10.42	2.01	2.30	72.28	1.61	11.38	1.82	Do.
1803	Tuscan Island	...do	...do	...do	1883	4.055	10.52	2.03	2.69	72.40	1.51	10.85	1.74	Do.
1804	Rogers Red	...do	...do	Soft	1883	2.011	9.36	2.17	2.50	73.24	1.88	10.85	1.74	Do.
1805	Dot	...do	...do	Medium	1883	3.710	10.21	2.18	2.37	72.85	1.54	10.85	1.74	Do.
1806	Clawson	...do	Amber	Hard	1883	2.242	9.81	2.09	1.94	74.37	1.81	9.98	1.60	Do.
1807	Rice	...do	Red	Medium	1883	[illegible].731	10.78	2.02	2.42	71.67	1.56	11.55	1.85	Do.
1808	Bill Dallas	...do	Amber	Hard	1883	4.647	11.03	1.77	2.01	73.72	1.32	10.15	1.62	Do.
1809	Tennessee Amber	...do	...do	...do	1883	3.486	10.84	1.96	2.07	72.57	1.53	11.03	1.76	Do.
1810	Emporium	...do	Red	...do	1883	2.794	11.62	1.91	2.04	70.93	1.60	11.90	1.90	Do.
1811	Lovell's New	...do	Amber	Medium	1883	2.183	11.57	2.19	2.28	72.42	1.74	9.80	1.57	Do.
1812	Washington Glass	...do	White	...do	1883	2.166	10.84	2.12	2.42	73.02	1.80	9.80	1.57	Do.
1813	Eureka	...do	Amber	...do	1883	2.675	11.43	1.96	2.09	71.49	1.65	11.38	1.82	Do.
1814	Purple Straw	...do	Light red	Hard	1833	2.823	12.12	1.94	2.40	68.99	1.77	12.78	2.04	Do.
1815	Kilpatrick Rust Proof	...do	Red	Very hard	1883	4.265	12.36	1.88	2.13	69.89	1.49	12.25	1.96	Do.
1816	Hughes' Rust Proof	...do	...do	Hard	1883	3.594	12.18	1.90	2.07	68.52	1.68	13.65	2.18	Do.
1817	Red Mediterranean	...do	...do	...do	1883	4.077	9.68	2.01	2.22	72.29	1.55	12.25	1.96	Do.
	OHIO:													
4	Swamp	Winter	Red	Hard	1878	3.976	7.63	1.84	2.41	74.99	1.54	11.59	1.86	Department of Agriculture.
1827	Michigan Amber	...do	...do	...do	1883	3.637	11.30	1.99	1.40	71.80	1.78	11.73	1.88	Do.
	INDIANA:													
1830	Osterey	Winter	Yellow	Hard	1883	2.768	10.16	2.05	1.51	73.41	2.02	10.85	1.74	Department of Agriculture.
	MICHIGAN:													
.....	White Extra	Winter			1877	....	12.75	1.56	1.26	70.96	1.83	11.64	1.87	Atwater.
.....	Diehl	...do			1876	....	9.64	1.72	......	76.26	......	12.38	1.98	Kedzie.
.....	Do	...do			1876	....	12.18	1.82	......	72.22	......	13.78	2.20	Do.
.....	Do	...do			1876	....	12.68	1.77	......	73.74	......	11.81	1.89	Do.
.....	Do	...do			1876	....	10.25	1.50	......	76.37	......	11.88	1.90	Do.
.....	Soules	...do			1876	....	11.02	1.73	......	75.44	......	11.81	1.89	Do.

.....	Do	....do....			1876		10.07	1.89		74.59		13.45	2.16	Do.
.....	Lincoln	....do....			1876		13.38	1.56		73.16		11.90	1.90	Do.
.....	Do	....do....			1876		10.78	1.75		76.09		11.38	1.82	Do.
.....	Fultz	....do....			1876		11.45	1.74		75.22		11.59	1.86	Do.
.....	Do	....do....			1876		12.53	1.74		71.26		14.47	2.31	Do.
.....	Treadwell	....do....			1876		12.69	1.71		73.10		12.50	2.00	Do.
.....	Do	....do....			1876		9.94	1.80		76.57		11.69	1.87	Do.
.....	Do	....do....			1876		10.00	1.76		76.36		11.88	1.90	Do.
.....	Buckeye	....do....			1876		12.73	1.38		74.92		10.97	1.75	Do.
.....	Tappahanock	....do....			1876		11.21	1.77		73.46		13.56	2.17	Do.
.....	Lancaster	....do....			1876		11.93	1.82		72.25		14.00	2.24	Do.
.....	Asiatic	....do....			1876		11.11	1.70		74.94		12.25	1.96	Do.
.....	Gold Medal	....do....			1876		10.55	1.73		76.57		11.15	1.78	Do.
.....	Do	....do....			1876		10.12	2.00		74.82		13.06	2.08	Do.
.....	Egyptian	....do....			1876		11.48	1.69		75.64		11.19	1.79	Do.
.....	Clawson	....do....			1876		12.29	1.64		74.19		11.88	1.90	Do.
.....	Do	....do....			1876		11.30	1.74		76.02		10.94	1.75	Do.
.....	Do	....do....			1876		12.29	1.79		74.76		11.16	1.78	Do.
.....	Do	....do....			1876		10.36	1.64		76.19		11.81	1.89	Do.
.....	Do	....do....			1876		11.19	1.76		74.99		12.06	1.93	Do.
.....	Do	....do....			1876		11.09	1.64		74.89		12.38	1.98	Do.
.....	Do	....do....			1876		11.08	1.49		75.18		12.25	1.96	Do.
.....	Do	....do....			1876		10.43	1.70		75.18		12.69	2.03	Do.
.....	Do	....do....			1876		10.31	1.60		75.84		12.25	1.96	Do.
.....	Do	....do....			1876		13.00	1.79		73.84		11.37	1.82	Do.
.....	Weeks	....do....			1876		10.03	1.59		77.38		11.00	1.76	Do.
.....	Powers	....do....			1876		10.85	1.70		75.42		12.03	1.92	Do.
.....	Armstrong	....do....			1876		12.21	1.97		72.94		12.88	2.06	Do.
.....	Tuscan	....do....			1876		13.77	1.72		73.14		11.37	1.82	Do.
.....	Post	....do....			1876		10.27	1.58		76.90		11.25	1.78	Do.
1293	Silver Chaff	....do....	White	Soft	1879	4.196	10.25	1.00	1.70	75.00	1.20	10.85	1.75	Department of Agriculture.
1294	Louisiana	....do....	....do....	Medium	1879	3.738	10.30	1.60	2.07	73.73	1.80	10.50	1.68	Do.
1295	Jersey Red	....do....	Red	Hard	1879	3.981	9.05	1.70	2.17	73.17	2.18	11.73	1.88	Do.
1296	Powers	....do....	White	....do....	1879	3.611	9.70	1.05	1.79	75.91	1.05	10.50	1.68	Do.
1297	Dot	....do....	Red	....do....	1879	4.535	9.70	1.90	2.23	71.94	1.80	12.43	1.99	Do.
1298	Michigan Wick	....do....	White	....do....	1879	3.931	9.65	1.65	2.09	73.88	2.05	10.68	1.71	Do.
1299	Schaefer	....do....	Yellow	Medium	1879	4.269	9.35	1.65	2.12	73.80	1.88	11.20	1.79	Do.
1340	Lancaster Red	....do....	Red	Hard	1879	4.625	11.25	1.80	2.21	69.96	1.83	12.95	2.07	Do.
1341	Velvet Chaff	....do....	Yellow	....do....	1879	4.135	11.50	2.05	2.17	68.60	1.68	14.00	2.24	Do.
1342	Shumaker	....do....	Amber	....do....	1879	4.525	11.10	1.35	1.97	71.38	1.60	12.60	2.02	Do.
1343	Armstrong	....do....	Yellow	....do....	1879	3.983	10.60	1.70	2.30	72.62	2.10	10.68	1.71	Do.
1344	Muskingum	....do....	Red	Medium	1879	4.010	11.35	1.40	2.16	70.59	1.90	12.60	2.02	Do.
1345	Mediterranean	....do....	....do....	....do....	1879	4.902	10.90	1.25	1.98	69.41	1.23	15.23	2.44	Do.
1346	Red Russian	....do....	....do....	Soft	1879	4.809	10.40	2.05	2.31	71.38	1.78	12.08	1.93	Do.
1347	Diehl	....do....	White	....do....	1879	3.402	10.90	1.75	2.14	73.11	1.60	10.50	1.68	Do.
1348	Clawson	....do....	Yellow	Medium	1879	4.096	11.40	1.65	2.20	72.12	1.95	10.68	1.71	Do.
1349	Jennings	....do....	White	Soft	1879	3.926	11.65	1.85	1.99	70.61	1.65	12.25	1.96	Do.
1350	Buckeye	....do....	Yellow	....do....	1879	4.106	11.55	1.45	1.89	70.73	1.95	12.43	1.99	Do.
1351	Trump	....do....	....do....	....do....	1879	4.301	10.95	1.70	1.95	72.02	2.00	11.38	1.82	Do.
754	Shumaker	....do....	Amber	Hard	1882	4.377	10.05	2.08	2.45	74.01	2.28	9.13	1.46	Do.
755	Clawson	....do....	Yellow	Medium	1882	3.856	11.22	1.97	2.18	71.59	2.35	10.69	1,71	Do.

ANALYSES OF AMERICAN WHEATS ARRANGED BY STATES—Continued.

Serial number.	Name.	Spring or winter.	Color.	Consistency.	Year of growth.	Weight of 100 grains.	Water.	Ash.	Oil.	Carbhydrates.	Fiber.	Albuminoids.	Nitrogen.	Analyst.
	KENTUCKY:					Grams.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	
1280	Fultz	Winter	Red	Hard	1882	3.666	10.55	1.40	2.30	71.87	1.98	11.90	1.90	Department of Agriculture.
1837	Rice	do	do	do	1883	3.465	10.53	1.79	1.99	69.55	1.61	14.53	2.32	Do.
1838	Do	do	do	do	1883	3.645	10.96	1.52	1.94	69.89	1.69	14.00	2.24	Do.
1910	Fultz	do	Amber	do	(?)	3.274	12.44	1.76	1.87	69.44	1.71	12.78	2.04	Do.
1913	Odessa	do	do	Soft	(?)	3.146	10.68	1.76	1.64	71.75	2.27	11.90	1.90	Do.
1916	German Amber	do	do	Medium	(?)	3.539	9.86	1.78	1.79	69.95	2.44	14.18	2.27	Do.
1917	White	do	White	Soft	(?)	3.395	9.94	2.07	1.65	71.22	2.34	12.78	2.04	Do.
1919	Fultz	do	Amber	Medium	(?)	3.502	11.68	1.88	1.80	69.26	2.25	13.13	2.10	Do.
	TENNESSEE:													
805	Swamp	Winter	Red	Hard	1881	3.660	7.10	2.10	2.08	70.24	1.85	16.63	2.66	Department of Agriculture.
775	Tennessee Amber	do	Amber	do	1882	3.204	9.90	1.85	2.09	72.78	1.48	11.90	1.90	Do.
776	Spark's Swamp	do	do	do	1882	3.551	10.24	1.80	2.31	72.37	1.73	11.55	1.85	Do.
1840	Rice	do	Red	do	1883	3.734	9.19	2.04	2.15	74.40	2.24	9.98	1.60	Do.
1824	White Mediterranean	do	White	Soft	1883	2.469	10.92	2.38	1.90	66.71	2.86	15.23	2.44	Do.
1843	Do	do	do	do	1883	2.138	10.64	2.10	2.04	72.87	2.20	10.15	1.62	Do.
775	Tennessee Amber	do	Amber	Medium	1883	3.204	9.90	1.85	2.09	72.78	1.48	11.90	1.90	Do.
1909	Do	do	Yellow	Soft	(?)	2.448	11.10	1.62	2.06	70.95	1.67	12.60	2.02	Do.
1911	Red	do	Amber	Hard	(?)	2.568	11.85	1.90	2.00	71.57	1.83	10.85	1.74	Do.
1912	Bearded	do	do	Soft	(?)	3.326	11.30	1.90	2.12	69.71	2.54	12.43	1.99	Do.
1914	Fultz	do	do	Medium	(?)	2.761	10.64	1.60	2.16	70.87	2.13	12.60	2.02	Do.
1915	Do	do	do	do	(?)	3.737	10.66	1.92	1.87	71.11	2.36	12.08	1.93	Do.
1918	California Gold Chaff	do	do	Hard	(?)	3.301	10.26	1.72	1.69	68.72	2.21	15.40	2.46	Do.
835	Swamp	do	do	do	1882	3.990	8.95	1.65	2.20	73.60	1.70	11.90	1.90	Do.
	DAKOTA:													
768	Castle Fife	Winter		Hard	1882	3.573	10.98	2.20	2.11	72.20	1.83	10.68	1.71	Department of Agriculture.
810	Scotch Fife	Spring		do	1882	2.755	10.08	1.80	2.25	69.69	1.83	14.35	2.30	Do.
	MINNESOTA:													
	Fife No. 1			Hard	1882	2.732	12.34	1.59			2.03	13.06	2.09	Noyes.
	Fife No. 2			do	1882	2.109	11.31	1.92			2.37	13.00	2.08	Do
	Fife No. 3			do	1882	2.037	11.85	1.97			2.50	13.56	2.17	Do
1900	Egyptian		Yellow	Hard	(?)	3.828	10.44	1.95	1.77	70.99	1.55	13.30	2.13	Department of Agriculture.
1901	Scoch Fife		Amber	Medium	(?)	3.154	10.62	1.90	2.08	72.24	2.31	10.85	1.74	Do.
1902	Red Fern		do	do	(?)	3.192	11.74	1.91	2.16	64.84	2.20	17.15	2.74	Do.
1903	Fife		Yellow	Soft	(?)	3.046	10.31	1.79	2.16	69.37	2.89	13.48	2.16	Do.
1904	Old Settlers		Red	Medium	(?)	3.364	10.10	1.57	1.83	72.26	1.81	12.43	1.99	Do.
1905	Red Fern		do	do	(?)	3.242	10.08	1.43	2.19	72.09	1.96	12.25	1.96	Do.
1906	Fife		Amber	Soft	(?)	3.116	11.34	1.50	2.02	71.77	1.82	11.55	1.85	Do.

1907	Golden Drop		do	do	(?)	3.545	11.10	1.53	1.89	71.97	1.96	11.55	1.85	Do.
1908	White Fife		White	Medium	(?)	3.699	9.70	1.80	2.19	73.05	1.88	11.38	1.82	Do.
	MISSOURI:													
....	Red	Winter	Red	Hard	(?)	....	13.52	1.55	1.47	69.95	1.72	11.73	1.89	Atwater.
3	Yellow	do	Yellow	do	1878	3.098	7.69	1.91	2.11	75.17	1.53	11.59	1.86	Department of Agriculture.
756	Fultz	do	Red	do	1879	3.455	10.28	1.80	2.28	72.86	2.28	10.50	1.68	Do.
757	Shumaker	do	do	do	1879	3.349	8.64	1.99	2.33	72.11	2.49	12.44	1.99	Do.
758	Zimmerman	do	do	do	1879	3.867	9.18	2.01	2.35	72.51	2.57	11.38	1.82	Do.
759	Clawson	do	Amber	do	1879	3.860	9.18	1.91	2.16	73.28	2.28	11.19	1.79	Do.
760	Russian No. 2	do	Yellow	do	1879	3.475	8.43	2.09	2.23	73.53	2.72	11.00	1.76	Do.
761	Smooth Mediterranean	do	Amber	do	1879	3.583	9.45	1.89	1.80	72.43	2.68	11.75	1.88	Do.
762	Silver Chaff	do	do	do	1879	3.492	10.99	2.22	2.42	70.89	2.29	11.19	1.79	Do.
778	Osterey	do	do	do	1882	3.340	11.48	1.90	2.36	70.95	1.88	11.43	1.92	Do.
1836	Rice	do	Red	do	1883	....	9.36	1.88	2.37	70.62	1.77	14.00	2.24	Do.
1835	Tennessee Amber	do	Amber	do	1883	....	9.41	1.88	2.35	74.01	1.85	10.50	1.68	Do.
	KANSAS:													
1935	....	....	White	Soft	(?)	3.424	11.58	1.72	1.98	71.87	2.01	10.85	1.74	Department of Agriculture.
1936	....	....	Red	Medium	(?)	3.332	11.77	1.84	2.07	71.15	1.97	11.20	1.79	Do.
1937	....	....	White	Soft	(?)	3.349	11.60	1.78	2.04	72.19	1.89	10.50	1.68	Do.
1938	....	....	Red	Hard	(?)	2.995	11.36	1.54	1.91	70.18	2.76	12.25	1.96	Do.
1939	....	....	do	Medium	(?)	3.331	11.57	1.47	2.02	72.29	1.62	11.03	1.76	Do.
1940	....	....	do	do	(?)	3.405	12.38	1.58	1.83	71.96	1.75	10.50	1.68	Do.
1941	....	....	Amber	do	(!)	2.975	12.27	1.61	2.01	70.12	2.09	11.90	1.90	Do.
1942	....	....	White	Soft	(!)	3.390	12.10	1.70	1.96	71.73	1.66	10.85	1.74	Do.
1943	....	....	Amber	Medium	(?)	2.881	11.62	1.66	2.12	70.87	3.05	10.68	1.71	Do.
1944	....	....	Red	do	(?)	2.956	11.76	1.5[illegible]	1.83	71.15	2.03	11.73	1.88	Do.
	TEXAS:													
1920	....	....	Red	Medium	(?)	2.606	10.64	1.92	2.39	70.23	2.39	12.43	1.99	Department of Agriculture.
1921	....	....	do	Hard	(?)	2.663	9.70	1.66	2.56	71.14	1.99	12.95	2.07	Do.
1922	....	....	do	do	(?)	2.708	9.26	2.18	1.94	70.19	2.08	14.35	2.30	Do.
1923	....	....	do	do	(?)	2.826	9.36	1.64	2.15	70.95	2.25	13.65	2.18	Do.
1924	....	....	Amber	do	(?)	2.699	9.50	1.60	2.00	73.86	2.01	11.03	1.76	Do.
1925	....	....	White	Soft	(?)	3.937	9.50	1.94	1.89	71.13	1.89	13.65	2.18	Do.
1926	....	....	Amber	do	(?)	2.409	9.66	2.43	1.86	69.68	2.19	14.18	2.27	Do.
1927	....	....	do	Hard	(?)	2.631	10.26	1.86	1.96	70.37	1.90	13.65	2.18	Do.
1928	....	....	Red	Medium	(?)	2.690	10.24	1.72	1.76	71.46	2.22	12.60	2.02	Do.
1929	....	....	Amber	do	(?)	2.608	10.00	1.52	1.92	70.55	2.01	14.00	2.24	Do.
1930	....	....	do	Soft	(?)	2.714	9.62	1.68	1.72	70.79	2.19	14.00	2.24	Do.
1931	Nicaraguan	....	Yellow	Hard	(?)	3.136	10.00	1.72	1.83	69.55	2.20	14.70	2.35	Do.
1932	....	....	White	Soft	(?)	4.740	10.28	1.80	2.46	72.73	2.05	10.68	1.71	Do.
1933	....	....	Red	do	(?)	2.622	10.04	1.76	2.46	70.95	2.19	12.60	2.02	Do.
1934	....	....	do	Medium	(?)	2.561	10.00	1.76	2.83	70.78	2.03	12.60	2.02	Do.
1819	Red Mediterrean	Winter	do	Hard	1883	3.525	8.88	2.02	2.34	69.44	2.09	15.23	2.44	Do.
1826	Do	do	do	do	1883	3.320	11.61	1.69	2.08	70.62	1.92	12.08	1.93	Do.
1825	White Mediterranean	do	White	Soft	1883	3.700	12.05	2.02	1.59	68.95	1.91	13.48	2.16	Do.
1610	Nicaraguan	do	Glossy	Hard	1882	....	9.94	1.58	2.29	72.75	1.71	11.73	1.88	Do.
	COLORADO:													
719	Hybrid No. 10	Winter	Amber	Hard	1881	....	9.72	2.28	2.16	70.77	1.32	13.75	2.20	Department of Agriculture.
720	Hybrid No. 15	do	Red	do	1881	....	10.07	1.93	2.68	71.50	1.57	12.25	1.96	Do.
721	Hybrid No. 16	do	do	Medium	1881	4.824	9.53	2.04	2.54	72.52	1.62	11.75	1.88	Do.
722	Hybrid No. 17	do	do	Hard	1881	5.137	9.93	2.07	3.93	68.86	1.59	13.62	2.18	Do.
723	Hybrid No. 18	do	....	....	1881	....	9.74	2.19	1.58	71.95	1.60	12.94	2.07	Do.

ANALYSES OF AMERICAN WHEATS ARRANGED BY STATES—Continued.

Serial number.	Name.	Spring or winter.	Color.	Consistency.	Year of growth.	Weight of 100 grains.	Water.	Ash.	Oil.	Carbhydrates.	Fiber.	Albuminoids.	Nitrogen.	Analyst.
	COLORADO—Continued:					*Grams.*	*Per ct.*	*Perct.*	*Perct.*	*Per ct.*	*Perct.*	*Per ct.*	*Perct.*	
724	Hybrid No. 19	Winter			1881		10.45	2.54	2.19	70.59	1.79	12.44	1.99	Department of Agriculture.
725	Hybrid No. 20	...do			1881		10.57	3.57	2.32	69.62	1.67	12.25	1.96	Do.
726	New South Wales seed	...do	Yellow	Medium	1881	4.657	9.47	2.18	2.40	71.78	1.55	12.62	2.02	Do.
727	Centennial	...do			1881		9.66	2.35	2.00	72.83	1.10	12.06	1.93	Do.
728	El Dorado	...do	Yellow	Hard	1881	4.702	10.55	2.24	2.43	71.93	1.10	11.75	1.88	Do.
729	White Mexican	...do			1881		9.91	2.60	1.89	70.27	1.52	13.81	2.21	Do.
730	Judkin	...do	Red	Hard	1881		9.75	2.57	2.42	71.31	1.70	12.25	1.96	Do.
731	Australian	...do	Yellow	Soft	1881	5.506	9.78	1.85	2.23	73.50	1.45	11.19	1.79	Do.
732	Fountain	...do	...do	Hard	1881	5.100	10.58	2.70	2.15	69.63	1.32	13.62	2.18	Do.
733	Perfection	...do	...do	...do	1881	5.536	9.93	1.99	2.32	70.03	1.55	14.18	2.27	Do.
734	Russian	...do	Red	Soft	1881	4.131	9.55	1.99	2.62	69.86	1.49	14.49	2.31	Do.
735	Rio Grande	...do	...do	...do	1881	5.906	9.51	2.08	2.96	68.97	1.79	14.69	2.35	Do.
736	Touselle	...do	Yellow	Medium	1881	5.214	10.23	2.10	2.35	70.17	1.65	13.50	2.16	Do.
737	German Fife	...do	Red	Soft	1881	5.368	10.42	2.31	2.79	67.94	1.48	15.06	2.41	Do.
738	Oregon Club	...do	Yellow	...do	1881	4.434	9.59	1.91	2.19	72.46	1.60	12.25	1.96	Do.
739	Sonoro	...do	...do	...do	1881	4.739	10.17	2.02	2.13	70.10	1.40	14.18	2.27	Do.
740	Imperial Fife	...do	...do	Hard	1881	4.147	9.48	2.64	2.31	68.00	1.63	15.94	2.55	Do.
741	Lost Nation	...do	Red	Medium		3.851	10.24	2.17	2.90	69.93	1.74	12.93	2.07	Do.
742	Pringles No. 6	...do	Yellow	...do		5.145	9,89	2.13	2.52	70.63	1.70	13.13	2.10	Do.
743	Pringles No. 7	...do	Amber	Hard		4.636	9.89	2.23	2.20	68.65	1.78	15.25	2.44	Do.
744	Clawson	...do	Yellow	Soft		4.565	10.14	1.94	2.31	72.26	1.60	11.75	1.88	Do.
745	Hedge Row	...do	...do	Medium		4.072	9 07	2.08	2.11	71.50	1.62	13.62	2.18	Do.
746	Do	Spring	Amber	Hard		4.499	9.17	2.59	2.09	71.88	1.33	12.94	2.07	Do.
747	White Chaff	Winter	Red	Soft		4.214	9.57	2.13	2.44	69.64	2.18	14.04	2.25	Do.
748	Triticum	...do	Yellow	Hard	1881	5.754	10.02	2.67	2.65	69.53	1.51	13.62	2.18	Do.
749	Durun Russia	...do	Amber	...do	1881	5.924	9.91	2.32	2.00	68.98	1.54	15.25	2.44	Do.
750	Doty	...do	Red	Soft	1881	4,373	9.41	2.35	2.50	69.94	1.80	14.00	2.24	Do.
751	Meekins	...do	...do	...do	1881	5.193	9.38	2.53	2.97	68.38	1.59	15.15	2.43	Do.
786	McGehee's Red	...do	...do	Hard	1882	4.159	7.85	1.85	1.97	72.53	1.80	14.00	2.24	Do.
788	Finlay	...do	...do	...do	1882	4.125	9.30	1.85	2.36	72.16	1.73	12.60	2.02	Do.
790	Champion Amber	...do	Amber	...do	1882	4.347	8.20	2.20	2.47	73.68	1.55	11.90	1.90	Do.
792	Dallas	...do	Red	...do	1882	4.670	10.05	1.85	2.46	69.38	1.73	14.53	2.32	Do.
794	Bennet	...do			1882	3.976	7.85	2.29	2.58	71.67	2.05	13.65	2.18	Do.
796	Lemon	...do			1882	4.335	8.45	2.05	2.14	73.25	1.68	12.43	1.99	Do.
798	Gold Medal	...do			1882	4.375	9.25	1.80	2.26	72.71	1.73	12.25	1.96	Do.
800	German Amber	...do	Amber	Medium	1882	4.027	8.80	1.80	2.42	72.80	1.75	12.43	1.99	Do.
802	Rice	...do	Red	Hard	1882	4.103	8.50	2.10	2.39	70.86	1.97	14.18	2.27	Do.
804	Washington Glass	...do			1882	4.450	8.60	1.95	2.41	74.31	1.18	11.55	1.85	Do.

806	Swamp	....do			1882	4.423	10.15	2.05	2.29	69.31	1.85	14.35	2.30	Do.
808	Wysor	....do			1882	4.609	8.55	2.25	2.20	72.27	2.13	12.60	2.02	Do.
	OREGON:													
.....	Clawson	Winter					12.99	1.77	......	74.74	......	10.50	1.68	Kedzie.
.....	Sonora Club	(?)					10.91	1.46	......	77.00	......	10.63	1.70	Do.
10	White	Winter			1878		9.52	1.57	1.69	77.11	1.53	8.58	1.37	Department of Agriculture.
14	Chili Club	Spring			1878		7.90	1.56	2.33	78.66	1.41	8.14	1.30	Do.
15	Noah Island	....do			1878		9.64	2.00	2.06	75.18	1.92	9.20	1.47	Do.
772	Hudson Bay	Winter			1882	4.253	10.97	1.75	2.31	74.51	1.88	8.58	1.37	Do.
773	Velvet Chaff	....do	White		1882	5.144	10.92	1.95	1.80	75.60	1.68	8.05	1.29	Do.
774	Red Chaff	Spring	Red		1882	5.745	10.68	2.20	2.16	74.91	1.65	8.40	1.34	Do.
7	Foisy	Winter					8.98	1.73	2.28	77.36	1.25	8.40	1.34	Do.
8	Brazilian	....do					9.29	1.95	1.99	76.13	1.17	9.47	1.51	Do.
	BRITISH COLUMBIA:													
.....	Soules				1876		8.51	1.63	......	77.61	......	12.25	1.96	Kedzie.
.....	Soules				1876		11.22	2.09	......	74.81	......	11.88	1.90	Do.

AVERAGES.

From the data obtained in the previous tables, excluding the incomplete analyses of Kedzie and Noyes, a table of averages has been calculated, which includes:

I. The average composition of the wheats of America.

II. The average composition of the wheats of the Atlantic and Gulf States, from Canada to Alabama, inclusive.

III. The average composition of the wheats of the middle West, limited by the Mississippi River.

IV. The average composition of the wheats of the West beyond the Mississippi, including Texas, Colorado, Kansas, Missouri, and Minnesota.

V. The average composition of the wheats of the Pacific slope, unfortunately, represented by only eight samples from Oregon.

VI. The average composition of the wheats grown in each of the States where as many as six specimens have been analyzed.

AVERAGE COMPOSITION OF AMERICAN WHEATS.

No. of analyses.	Locality.	Weight of 100 grains.	Water.	Ash.	Oil.	Carbhydrates.	Fiber.	Albuminoids.	Nitrogen.	Heaviest 100 grains.	Lightest 100 grains.	Highest albuminoids.	Lowest albuminoids.
		Grams.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Grams.*	*Grams.*	*Per cent.*	*Per cent.*
......	United States and Canada	3.638	10.27	1.84	2.16	71.98	1.80	11.95	1.91	5.924	1.830	17.15	8.05
108	Atlantic and Gulf States	3.464	10.42	1.75	2.17	72.61	1.72	11.33	1.81	5.079	2.138	15.58	9.45
47	The middle West	3.607	10.51	1.76	2.01	71.67	1.90	12.15	1.94	4.902	2.561	18.63	10.15
79	West of the Mississippi	3.806	10.04	1.99	2.22	71.12	1.87	12.76	2.04	5.924	(4.253)	17.15	10.15
8	The Pacific coast	5.044	9.74	1.84	2.08	76.18	1.56	8.60	1.37	(5.745)	1.830	9.47	8.05
6	Canada	3.325	9.74	1.56	2.29	73.87	1.67	10.87	1.74	3.686	2.964	14.70	9.45
32	Pennsylvania	3.373	10.72	1.67	2.05	72.45	1.73	11.38	1.82	4.658	2.035	15.58	9.45
9	Maryland	3.597	10.52	1.75	2.09	72.25	1.74	11.65	1.86	5.079	3.075	14.53	9.80
11	Virginia	3.343	10.34	1.70	2.21	71.87	1.71	12.71	1.95	4.208	1.830	14.00	10.15
7	Georgia	3.579	10.00	1.96	2.30	72.24	1.72	11.78	1.89	4.627	2.834	14.00	9.45
22	North Carolina	3.776	10.03	1.59	2.25	73.94	1.76	10.43	1.67	4.628	2.780	12.43	8.93
17	Alabama	3.314	10.94	2.03	2.21	71.84	1.62	11.36	1.79	4.647	2.011	13.65	9.80
....	Michigan (Kedzie)	....	11.28	1.73	....	74.97	....	12.02	1.92	....	....	13.78	9.13
22	Michigan	3.969	10.71	1.64	2.06	72.12	1.80	11.67	1.87	4.902	3.402	15.23	10.50
8	Kentucky	3.454	10.83	1.75	1.87	70.37	2.03	13.15	2.10	3.666	3.146	14.53	11.90
14	Tennessee	3.150	10.19	1.89	2.06	71.33	2.02	12.51	2.00	3.990	2.138	16.63	10.15
12	Missouri	3.502	9.80	1.92	2.19	72.36	2.17	11.56	1.86	3.867	3.098	14.00	10.50
9	Minnesota	3.354	10.60	1.71	2.03	70.96	2.04	12.66	2.03	3.828	3.116	17.15	10.85
10	Kansas	3.204	11.80	1.64	1.98	71.35	2.08	11.15	1.78	3.424	2.881	12.25	10.50
19	Texas	2.847	10.03	1.81	2.11	70.85	2.06	13.14	2.10	3.937	2.561	15.23	10.68
45	Colorado	4.682	9.57	2.21	2.38	70.91	1.62	13.31	2.13	5.924	3.851	15.94	11.19
8	Oregon	5.044	9.74	1.84	2.08	76.18	1.56	8.60	1.37	5.745	4.253	9.47	8.05

In my report for 1881–'82 a comparison was made of American with foreign wheat from the data then at hand. The conclusion there reached, that our wheats *as a rule* were inferior, seems to be supported by the more extended averages obtained this year, as may be seen by a comparison of the preceding table with the following averages for foreign wheats:

AVERAGE COMPOSITION OF FOREIGN WHEATS.

Locality.	Authority.	Number of analyses.	Water.	Ash.	Oil.	Carbhydrates.	Fiber.	Albuminoids.	Maximum albuminoids.	Minimum albuminoids.
			Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Russian	Laskowsky.	24	11.49	......	1.57	....	......	19.48	24.56	10.68
German	Wolff	......	14.40	1.70	1.50	66.40	3.00	13.00	....	....
Continental	Peligot	14	14.00	1.60	1.20	66.90	1.70	14.60	21.50	10.60
Do	Millon	16	13.82	1.57	1.74	70.13	1.70	11.04	13.81	9.92
Do	Reiset	20	14.43	1.99	......	70.58	......	13.00	17.94	10.69
World	Konig	200	13.56	1.79	1.70	67.87	2.66	12.42	24.16	8.19
Do	Kühn	......	14.30	1.70	1.60	66.20	3.00	13.20	24.10	8.20

It is apparent that the average American wheat is distinguished by a deficiency in albuminoids. In other respects it is lighter per hundred grains and contains less water and fiber, with more oil and about the same amount of ash.

From a study of the States we learn that there is a great variation in composition in different parts of the country. The Atlantic coast produces the poorest article, the middle West improves upon this, while beyond the Mississippi a wheat is harvested which equals that grown abroad; and again, on the Pacific coast the grain, though large and fine-looking, is deficient in albumen.

Among the individual States, Colorado sustains the reputation which was gained in last year's report of producing the finest wheat. Texas nearly equals it in composition, but the grain is deficient in size and plumpness. Minnesota, all things considered, probably ranks next to Colorado.

The great variation in the size and composition of the grain under different circumstances is very striking. The extent is given in the following table:

VARIATIONS IN COMPOSITION AND WEIGHT OF WHEATS.

Constituents.	Highest percentage.	Lowest percentage.	Variation.	Above average.	Below average.
Water	12.44	7.85	4.59	2.02	2.57
Ash	3.57	.80	2.77	1.82	.95
Oil	3.93	1.40	2.53	1.76	.77
Carbhydrates	78.66	64.84	13.82	6.68	7.14
Fiber	3.05	.44	2.61	1.25	1.36
Albuminoids	17.15	8.05	9.10	5.20	3.90
Weight of 100 grains ....grams	5.924	1.830	4.094	2.286	1.888

While the variation of all the constituents is large, that of the albuminoids is most striking, and it is the general peculiarity of the wheat-grain that the percentage of nitrogen which it contains is so susceptible to the conditions of growth.

In foreign wheat, as has been already seen, the nitrogen often reaches higher percentages than in the American grain. A small table has been prepared for the purpose of showing this fact:

MAXIMA AND MINIMA OF ALBUMINOIDS, PERCENTAGE OF NITROGEN, AND WEIGHT OF 100 GRAINS OF WHEAT.

Locality.	Authority.	Number of analyses.	Nitrogen.	Albuminoids.	Maximum albuminoids.	Minimum albuminoids.	Weight of 100 grains.		
							Average.	Highest.	Lowest.
			Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Grams.*	*Grams.*	*Grams.*
North German	Von Bibra	25	2. 20	13. 76	18. 25	9. 80	4. 270	7. 450	3. 200
South German	....do	20	2. 13	13. 28	17. 81	9. 68	4. 473	7. 000	2. 875
Scotch	....do	14	2. 07	12. 95	14. 63	11. 06	4. 679	5. 200	3. 850
Egypt	....do	5	1. 46	9. 10	9. 94	8. 75			
Australian	....do	2	1. 60	9. 98	9. 98	9. 94			
Algerian	....do	13	2. 20	13. 75	15. 50	11. 25	5. 540	6. 525	4. 600
Spanish	....do	9	2. 30	14. 35	24. 13	11. 25	4. 278	5. 125	3. 850
Russian	....do	7	2. 45	15. 31	21. 70	10. 44	3. 950	5. 350	1. 800
Do	Laskowsky	24	3. 13	19. 48	24. 16	60. 68			
Germany	Mayer		2. 20	13. 75					
Do	Wolff		2. 08	13. 00					
Continental	Millon	15	1. 88	11. 75	12. 63	9. 88			
Do	Peligot	12	2. 23	13. 97	21. 50	9. 90			
Do	Reiset	20	2. 04	12. 78	17. 90	10. 68			
Average, excluding Russia.	König	176	1. 98	12. 35	21. 37	7. 61			
Average of world	Kühn		2. 11	13. 20	24. 10	8. 20			

While among our wheats the highest percentage of albumen was found to be 17.15 in a wheat from Minnesota, Russian grain has been analyzed by Laskowsky which contained 24.56 per cent., twenty-four different specimens averaging 19.48 per cent., the lowest having 10.68 per cent. of albumen. The range is largely extended by these analyses, and if the wheats of all countries are taken into consideration, it rises to 19.23 per cent., and the great susceptibility of wheat in this direction is made manifest. As the albuminoids are regarded, and probably rightly, as the most valuable part of the grain, when properly elaborated, the effect of environment on this constituent is one of the most important considerations in the study of the grain. As has been seen, the Colorado wheats are certainly the best which have been produced in this country. For two years they have sustained a high average composition and a large weight per hundred grains, as the following figures show:

AVERAGE COMPOSITION OF COLORADO WHEATS.

Constituents.	1881.	1882.
Water	9. 86	8. 80
Ash	2. 28	1. 99
Oil	2. 41	2. 33
Carbhydrates	70. 48	72. 08
Fiber	1. 57	1. 76
Albuminoids	13. 40	13. 04
Nitrogen	2. 14	2. 09
Weight of 100 grains ......grams	4. 865	4. 292

The question arises, Why do they excel in this manner? It is due somewhat to careful cultivation and selection of the seed, but more

largely to soil and climate, as is proved by the experiments of last year. In the autumn of 1881 thirteen selected seed-wheats were sent to Professor Blount by the Department, and after harvest a portion of the seed furnished and of the crop was returned for inspection and analysis. To the eye alone they had all improved in appearance, and as a whole their average composition was very close to the average of the domestic varieties grown in 1881 on the same soil.

The changes which took place in the wheats individually, and as a whole, are shown in a table which has been prepared with all the analyses calculated to a common basis of 10 per cent. of water:

COMPARISON OF DEPATMENT SEED AND COLORADO CROP.

Variety.	Water.	Ash.	Oil.	Carbhydrates.	Fiber.	Albuminoids.	Weight of 100 grains.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Grams.*
McGehee's Red:							
Department	10.00	1.04	2.46	71.57	1.46	13.47	2.811
Colorado	10.00	1.80	1.92	70.85	1.76	13.67	4.159
Finlay:							
Department	10.00	1.59	2.37	73.72	1.17	11.65	3.285
Colorado	10.00	1.83	2.34	71.60	1.72	12.51	4.125
Champion Amber:							
Department	10.00	1.88	2.19	73.70	1.33	10.90	3.278
Colorado	10.00	2.16	2.42	72.24	1.52	11.66	4.347
Dallas:							
Department	10.00	2.10	2.43	71.54	1.61	12.32	4.023
Colorado	10.00	1.85	2.46	69.34	1.73	14.52	4.610
Bennett:							
Department	10.00	2.01	2.17	70.77	1.35	13.70	3.218
Colorado	10.00	2.15	2.52	70.00	2.00	13.33	3.976
Lemon:							
Department	10.00	1.87	2.46	68.87	1.50	15.30	3.417
Colorado	10.00	2.02	2.10	72.01	1.65	12.22	4.335
Gold Medal:							
Department	10.00	1.77	2.33	74.89	1.36	9.65	3.076
Colorado	10.00	1.78	2.24	72.11	1.72	12.15	4.274
German Amber:							
Department	10.00	1.66	2.57	74.01	1.02	10.74	2.938
Colorado	10.00	1.77	2.39	71.84	1.73	12.27	4.027
Rice:							
Department	10.00	2.11	2.28	69.73	1.60	14.28	3.586
Colorado	10.00	2.06	2.35	69.70	1.94	13.95	4.103
Washington Glass:							
Department	10.00	2.02	2.19	72.20	1.81	11.88	3.741
Colorado	10.00	1.92	2.37	73.16	1.16	11.39	4.450
Swamp:							
Department	10.00	2.04	2.01	68.05	1.79	16.11	3.660
Colorado	10.00	2.05	2.30	68.89	1.85	14.91	4.423
Wysor:							
Department	10.00	1.54	2.14	72.11	1.72	12.49	3.796
Colorado	10.00	2.22	2.16	71.13	2.09	12.40	4.609
Average seed:							
Department	10.00	1.80	2.30	71.72	1.47	12.75	3.402
Colorado	10.00	1.97	2.30	71.07	1.74	12.92	4.299
Gain for crop	....	9	7	9	11	6	12
Loss	....	3	5	3	1	6	0

The average composition of the seed is, to begin with, remarkably good, showing that they were of fine quality, or at least a majority of them. The average for the crop shows a slight gain over the seed in ash, no change in oil, a slight loss in starch, a slight gain in fiber and albuminoids. The first question that arises is, Why have the albuminoids failed to improve more? This is explained by a study of the analyses separately. The average amount of albumen found in Mr. Blount's wheats of 1881 from domestic sources was 1.304, and in the analyses of the 1882 crops it will be seen that those which were from seed containing high amounts of albumen fell toward the average figure, while those low in albumen had a tendency to rise toward it; that is to

say, six improved their albuminoids and six depreciated, the average agreeing with that of 1881, which seems to point to the fact that the Colorado soil has a capacity for supporting a percentage of albumen in a wheat of about thirteen, and that if a variety in the seed has more than this it will tend to decrease to that figure, and *vice versa*. For example, a wheat having 16.11 per cent. in the grain sown contained only 14.01 per cent. in the grain harvested, and one having 9.65 per cent. in the seed increased to 12.15 per cent. Of course a fall happens much more readily than the reverse. The Washington Glass, having only 11.88 per cent. of albumen in the seed, failed to improve, but this is owing to an inherent dislike of this wheat, wherever it grows, to assimilate nitrogen, a peculiarity which Colorado could not overcome. As to the other constituents, the ash increased in nine cases out of twelve, the new soil furnishing a large supply of mineral food, the oil in seven, and the fiber in eleven cases. The increase of the latter seems to be a common accompaniment of flourishing growth. In every case the size and general appearance was much improved, and as a consequence the weight of 100 grains of the crop was much heavier than of the seed; in fact, averaged over 26 per cent. heavier.

Of the 44 wheats from Colorado grown during two years only one fell below 11½ per cent. of albumen, and only six below 12 per cent. Only two of this number weighed less than four grams per hundred grains. In North Carolina, on the contrary, 22 of whose wheat were analyzed, only two exceeded 12 per cent. of albumen, while the weight of 100 grains averaged as high as 3.776 grams In Oregon another phase is presented, as has been before mentioned Out of eight wheats which were analyzed by us none contained more than 9.47 per cent. of albumen, or weighed less than 4.253 grams per hundred grains In Virginia a stunted wheat was found weighing only 1.830 grams per hundred grains, and yet having 14 per cent. of albumen. The effect of locality is well represented by these two facts, and the necessity for a determination of the weight of 100 grains is apparent when a few of these exceptional analyses are printed side by side. From the chemical analysis alone we should be misled as to the value of the wheats which follow :

Analysis of wheats from different States.

	Oregon.	Colorado.	North Carolina.	Virginia.
Yield per acre	Large.	Large.	Medium.	7 bushels.
Weight of 100 grains ....grams..	5.745	5.193	4.628	1.830
Water ....per cent..	10.68	9.38	9.30	9.45
Ash ....do....	2.20	2.53	1.80	2.45
Oil ....do....	2.16	2.97	2.25	2.18
Carbhydrates ....do....	74.91	68.38	75.42	70.02
Fiber ....do....	1.65	1.59	1.95	1.90
Albuminoids ....do....	8.40	15.15	9.28	14.00
Nitrogen ....per cent..	1.34	2.43	1.43	2.24

Too much confidence, it is seen, cannot be placed on the size and appearance of a wheat, or, conversely, on the chemical analysis alone. When both these elements in its constitution are favorable, then alone can it be pronounced a good wheat.

The effects upon the composition of grain which we have studied seem to be largely dependent on the soil, seed and cultivation being

the same. A good illustration of this is furnished by some analyses which were lately made of seed which was sown in 1882 on corn-ground and fallow land on a farm in Maryland belonging to Judge John M. Robinson, and of the crops of the two fields.

Fultz wheat, Queen Anne County, Maryland.

	Seed, 1882.	Corn, ground, 1883.	Fallow, 1883.
Weight of 100 grains .... grams..	3.198	3.685	3.602
Water .... per cent..	11.06	11.34	11.38
Ash .... do....	1.85	1.66	1.64
Oil .... do....	1.98	2.30	1.55
Carbhydrates .... do....	73.43	73.18	72.99
Fiber .... do....	1.70	1.72	1.59
Albuminoids .... do....	9.98	9.80	10.85
	100.00	100.00	100.00
Nitrogen .... per cent..	1.60	1.57	1.74

The better wheat season of 1883 in Maryland produced a heaver grain than 1882, but as the soil was unchanged in itself or by unusual application of fertilizers, the albuminoids increased only slightly on the fallow field. The latter, as one would expect, produces a grain richer in nitrogen than the corn-ground, from its accumulated store of nitrogen. The fallow crop, too, was larger in amount than that from the corn-ground.

In all cases wheat manifests its susceptibility to environment, although it is not always possible to explain why it varies in certain directions; why, for instance, Oregon produces as large crops and as fine-looking wheat as Colorado, but with less than three-quarters the amount of albuminoids. If this is the case with wheat, does it also hold good with other cereals? To ascertain, if possible, the following examination has been made of corn:

CORN (MAIZE).

The varieties of corn which have been analyzed include Red, Yellow, White, and Miscegenation Dent; Yellow, White, Blue Mexican, and Miscegenation Flint, and several kinds of sweet or sugar corn, and pop-corn. The analyses amount to 94 in number, to which have been added those of 32 field corns and 3 mature sugar corns by Johnson, Kedzie, and Atwater. The results are given in the following tables, arranged in the same manner as the wheats:

ANALYSES OF AMERICAN CORNS BY STATES.

No.	Name.	Variety.	Date.	Weight of 100 kernels.	Water.	Ash.	Oil.	Carbo-hydrates.	Fiber.	Albu-men.	Nitro-gen.	Analyst.
				Grams.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	
	NEW HAMPSHIRE:											
31	Small Eight-rowed	White corn	1878	....	11.05	1.57	4.80	67.63	1.30	13.65	2.18	Dep. of Agriculture.
33	Adams'	Yellow corn	1878	....	8.61	1.57	4.83	73.30	1.10	10.50	1.68	Do.
34	Canada	....do	1878	....	8.27	1.72	5.60	71.79	1.26	11.36	1.82	Do.
36	Small Twelve-rowed	....do	1878	....	11.48	1.34	6.03	69.56	1.09	10.50	1.68	Do.
37	State Fair Premium	....do	1878	....	10.19	1.78	5.29	70.86	1.06	10.82	1.74	Do.
38	Large Premium	....do	1878	....	10.00	1.46	5.52	70.57	1.09	11.36	1.82	Do.
39	Board of Agriculture	....do	1878	....	11.09	1.31	4.68	70.55	.82	11.55	1.85	Do.
40	King Philip	Red corn	1878	....	10.23	1.84	7.05	67.79	1.01	12.08	1.93	Do.
42	Miscegenation	White and blue	1878	....	9.92	1.63	5.33	70.35	1.05	11.72	1.88	Do.
43	Pitch-knot	....	1878	....	11.24	1.52	5.26	69.74	1.04	11.20	1.79	Do.
44	Tom Thumb Pop	Yellow corn	1878	....	9.05	1.60	5.89	69.53	1.33	12.60	2.02	Do.
	VERMONT:											
35	Vermont	Yellow corn	1878	....	8.64	1.45	5.63	72.76	1.38	10.14	1.62	Do
	PENNSYLVANIA:											
28	White Prolific	White corn	1878	....	8.96	1.43	5.82	74.49	1.25	8.05	1.29	Do.
32	Compton's Early	Yellow corn	1878	....	6.59	1.64	5.30	74.48	2.09	9.90	1.59	Do.
1235	Pride of North	Yellow Dent	1882	30.610	8.60	1.25	4.65	73.10	2.25	10.15	1.62	Do.
1259	Chester County Mammoth	...do	......	44.147	7.80	1.40	4.82	74.90	2.33	8.75	1.40	Do.
1272	Field Corn	Red Dent	......	37.202	7.85	1.45	5.49	75.73	1.95	7.53	1.20	Do.
	NORTH CAROLINA:											
26	White Dent	White Dent	1878	....	6.74	1.43	5.18	74.09	1.53	11.03	1.76	Do.
	KENTUCKY:											
1255	Willis	....do	......	32.457	7.70	1.50	5.33	73.47	2.20	9.80	1.57	Do.
	TENNESSEE:											
25	Improved Prolific	White corn	1878	....	7.58	1.23	5.09	74.16	2.65	9.29	1.48	Do.
	MISSOURI:											
1244	Tuscarora	White Flint	......	35.582	7.70	1.85	5.34	71.65	2.08	11.38	1.82	Do.
1245	Proctor's Bread	White Dent	......	30.837	7.90	1.65	4.65	74.12	2.05	9.63	1.54	Do.
1246	Long John	....do	......	41.689	8.05	1.75	4.87	72.22	2.08	11.03	1.76	Do.
1247	Saint Charles	....do	......	34.183	8.20	1.75	6.29	72.43	3.10	8.23	1.32	Do.
1248	Snow Flake	....do	......	52.679	7.80	1.65	4.34	74.83	1.75	9.63	1.54	Do.
1249	Ragan's White	....do	......	39.672	8.25	1.80	6.14	70.18	2.60	11.03	1.76	Do.
1250	Peabody	....do	......	32.323	7.95	2.05	7.49	69.93	2.60	9.98	1.60	Do.
1251	Badeau	....do	......	37.011	8.45	2.10	5.82	69.85	2.93	10.85	1.74	Do.
1252	Blount's Prolific	....do	......	38.753	8.05	2.05	5.33	70.34	1.98	12.25	1.96	Do.
1253	White Flint	White Flint	......	34.958	7.60	1.55	4.93	71.52	2.50	11.90	1.90	Do.
1254	Thompson's	White Dent	......	43.662	8.30	1.80	4.94	69.78	2.58	12.60	2.02	Do.
1256	Ragan's Yellow	Yellow Dent	......	42.651	8.50	1.45	4.85	73.44	2.13	9.63	1.54	Do.
1257	Chester County	....do	......	33.595	8.05	1.45	6.31	70.69	2.65	10.85	1.74	Do.
1258	Golden Yellow	....do	......	35.343	8.30	1.60	5.38	72.79	1.43	10.50	1.68	Do.

ANALYSES OF AMERICAN CORNS BY STATES—Continued.

No.	Name.	Variety.	Date.	Weight of 100 kernels.	Water.	Ash.	Oil.	Carbhydrates.	Fiber.	Albuminoids.	Nitrogen.	Analyst.
				Grams.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	
	CONNECTICUT:											
	Vermont White Cap	Flint corn	1877		10.86	1.53	4.29	71.22	1.04	11.06	1.76	S. W. Johnson.
	Rowley	....do	1877		11.00	1.61	4.83	70.15	.78	11.63	1.86	Do.
	Yellow-rowed or Canada	....do	1877		15.10	1.36	5.31	66.98	1.24	10.01	1.60	W. O. Atwater.
	Old Fashioned Yellow	....do	1878		10.58	1.43	4.68	72.11	1.39	9.81	1.57	S. W. Johnson.
	Ohio Dent	Dent corn	1877		10.78	1.37	5.14	71.30	1.35	10.06	1.76	Do.
	Coe's Prolific	....do	1878		9.55	1.45	3.98	72.70	2.19	10.13	1.62	Do.
	Benton	....do	1878		10.70	1.57	5.00	71.40	1.36	9.97	1.60	Do.
	Scioto	....do	1878		10.43	1.53	4.01	72.98	1.80	9.25	1.48	Do.
	White Ohio	....do	1878		9.70	1.79	4.20	71.30	1.73	11.28	1.80	Do.
	Wisconsin	....do	1878		9.72	1.56	4.89	70.17	2.06	11.60	1.85	Do.
	White Prolific	....do	1878		10.14	1.67	4.28	73.38	1.34	9.19	1.47	Do.
	Extra Early Adams	....do	1878		10.94	1.75	4.81	70.21	1.48	10.81	1.73	Do.
	Tuscarora	Unclassified	1877		11.25	1.47	5.74	68.82	1.28	11.44	1.83	Do.
	NORTH CAROLINA:											
	Norfolk White	Flint corn			11.17	1.31	4.70	70.04	1.90	10.88	1.74	S. W. Johnson.
	INDIANA:											
	White Oil	Dent corn			11.29	1.28	4.87	70.16	1.90	10.50	1.68	R. C. Kedzie.
	MICHIGAN:											
	Smut Nose	Flint corn			12.90	1.54	4.94	66.81	2.00	11.81	1.89	R. C. Kedzie.
	......do	....do			13.20	1.49	5.14	66.11	2.49	11.51	1.84	Do.
	Eight-rowed Flint	....do			13.45	1.43	4.83	66.03	2.26	12.00	1.92	Do.
	Sanford	....do			13.37	1.37	5.06	67.42	2.10	10.69	1.71	Do.
	Yellow Dent	Dent corn	1877		12.74	1.41	4.63	66.98	2.49	11.75	1.88	Do.
	......do	....do	1877		11.66	1.51	5.07	67.80	2.48	11.48	1.51	Do.
	White Dent	....do	1877		13.73	1.60	4.63	66.26	2.26	11.52	1.52	Do.
	Hackberry Dent	....do	1877		12.47	1.47	4.77	69.11	2.30	9.88	1.58	Do.
	Strawberry Roan	....do	1877		14.05	1.39	4.59	67.63	2.03	10.31	1.65	Do.
	Pony Dent	....do			13.42	1.40	4.83	66.94	2.16	11.25	1.80	Do.
	......do	....do			13.29	1.31	5.03	67.53	2.21	10.63	1.70	Do.
	Tuscarora	White Flint	1877		14.08	1.52	5.77	65.97	1.80	10.86	1.74	Do.
	UNKNOWN:											
	Western Yellow	Flint corn			13.93	1.25	3.92	70.49	1.59	8.82	1.41	W. O. Atwater.
	Southern White	....do			13.82	1.32	4.02	71.16	.88	8.80	1.41	Do.
	Early Dutton	....do			8.08	1.52	5.64	72.62	2.52	9.62	1.54	Do.
	Common Yellow or Canada	....do			10.52	1.31	4.42	71.63	2.40	9.72	1.56	Do.
	King Philip or Rhode Island	....do			9.79	1.60	4.45	70.08	2.21	11.87	1.90	Do.
	MISSOURI:											
1260	Pennsylvania	Yellow Flint		30.674	8.25	1.55	4.05	74.27	1.90	9.98	1.60	Dept. of Agriculture.
1261	Pale Yellow	Yellow Dent		44.251	8.55	1.65	5.16	72.23	2.55	9.80	1.60	Do.
1262	Golden Dent			35.336	7.50	1.50	4.76	71.51	1.95	12.78	2.04	Do.
1263	Early Canada	Yellow Flint		37.077	8.70	1.45	4.67	72.50	2.00	10.68	1.71	Do.
1264	Chester County Mammoth	Yellow Dent		39.807	7.60	1.85	6.93	70.34	2.95	10.33	1.65	Do.

1265	New Madrid	....do	......	32.031	7.40	1.50	5.81	71.96	2.65	10.68	1.71	Do.
1266	Early Yellow	....do	......	39.624	7.90	1.75	5.43	73.41	2.58	8.93	1.43	Do.
1267	Evans	....do	......	40.962	9.05	1.50	4.73	73.24	2.55	8.93	1.43	Do.
1268	Gold Dust	....do	......	43.263	8.75	1.55	4.95	70.92	2.28	11.55	1.85	Do.
1269	Bloody Butcher	Red Dent	......	37.774	8.70	1.70	4.78	72.61	2.23	9.98	1.60	Do.
1270	Long Yellow	Yellow Dent	......	38.062	8.80	1.30	4.88	73.04	2.00	9.98	1.60	Do.
1271	Jersey Red	Red Dent	......	45.870	8.30	1.75	4.39	72.26	2.45	10.85	1.74	Do.
	KANSAS:											
1962	Yellow Dent		......	34.436	11.84	1.69	5.11	68.82	2.04	10.50	1268	Do.
1963	Striped Red and Yellow Dent		......	32.206	12.10	1.60	4.66	69.09	2.40	10.15	1.62	Do.
1964	Dark Red Dent		......	32.150	12.26	1.36	4.47	68.93	2.65	10.33	1.65	Do.
1965	White Dent		......	35.798	12.06	1.56	5.69	68.44	2.10	10.15	1.62	Do.
1966	Yellow Dent		......	28.348	11.40	1.30	4.77	71.72	1.71	9.10	1.46	Do.
1967	White Dent		......	36.687	12.00	1.44	4.49	69.34	2.05	10.68	1.71	Do.
	COLORADO:											
1237	Blount's Prolific	Flint	1882	34.120	10.50	1.50	5.66	70.19	2.35	9.80	1.60	Do.
	TEXAS:											
1279	Wild Goose		......	43.799	8.40	1.45	4.91	72.71	2.20	10.33	1.65	Do.
1945	White and Yellow Dent Cross		......	31.364	10.10	1.44	5.33	68.96	3.84	10.33	1.65	Do.
1946	White Dent		......	40.926	9.70	1.70	5.10	69.25	3.22	11.03	1.76	Do.
1947	Red and Yellow Cross Dent		......	38.517	10.00	1.40	5.42	71.38	1.82	9.98	1.60	Do.
1948	Yellow and White Dent		......	38.465	10.36	1.04	5.29	70.02	2.61	10.68	1.71	Do.
1949	Red Dent		......	40.245	10.44	1.44	5.62	69.67	2.68	10.15	1.62	Do.
1950	White, Red, and Yellow Dent		......	36.366	10.52	1.60	5.20	68.07	4.81	9.80	1.57	Do.
1951	White Dent		......	40.881	10.84	1.56	5.57	69.12	2.41	10.50	1.68	Do.
1952	......do		......	40.435	10.60	1.32	5.32	67.74	4.17	10.85	1.74	Do.
1953	Yellow, Red, and White Dent		......	38.855	10.42	1.40	5.48	70.49	2.06	10.15	1.62	Do.
1954	White Dent		......	39.986	10.20	1.63	5.26	69.92	2.31	10.68	1.71	Do.
1955	Red and White Dent		......	31.547	10.14	1.38	4.97	70.78	2.40	10.33	1.65	Do.
1956	Yellow, Red, and White Dent		......	39.655	10.90	1.30	5.75	69.06	2.66	10.33	1.65	Do.
1957	Yellow, White, and Red Dent		......	38.526	10.05	1.49	5.36	70.19	2.23	10.68	1.71	Do.
1958	......do		......	39.583	10.49	1.52	5.58	69.65	2.96	9.80	1.57	Do.
1959	Yellow and White Dent		......	39.195	9.27	1.38	6.11	70.95	2.14	10.15	1.62	Do.
1960	White Dent		......	36.150	10.50	1.42	5.51	69.34	2.55	10.68	1.71	Do.
1968	Yellow Dent		......	32.398	11.98	1.32	5.15	67.79	2.73	11.03	1.76	Do.
1969	Yellow, Red, and White Dent		......	38.871	12.13	1.37	6.57	66.69	2.91	10.33	1.65	Do.
1970	White Dent		......	30.898	11.82	1.18	5.46	68.63	2.76	10.15	1.62	Do.
	OREGON:											
30	Oregon White	White corn	1878	....	9.25	1.46	7.08	73.07	1.26	7.88	1.26	Do.
	WASHINGTON TERRITORY:											
1236	Yakima City	Flint	1882	27.900	10.30	1.50	5.73	71.19	2.88	8.40	1.34	Do.
	MEXICO:											
27	White Mexican	White corn	1878	....	8.65	1.87	4.90	72.79	1.64	10.15	1.62	Do.
29	Mexican White Dent	White Dent	1878	....	11.14	1.45	6.28	68.87	1.59	10.67	1.71	Do.
41	Mexican	Blue corn	1878	....	8.97	1.42	5.25	72.35	1.80	10.21	1.63	Do.
	UNKNOWN:											
1224	Queen of the Prairie	Field corn*	1882	25.782	9.40	1.55	4.29	71.06	2.85	10.85	1.74	Do.
1274	Mexican No. 9	Blue, black, red, and white corn.	......	23.605	8.35	1.75	7.13	73.74	2.03	7.00	1.12	Do.
1278	Mexican	Flint	......	40.734	7.95	1.30	5.53	74.62	2.20	8.40	1.34	Do.
45	Pop-corn	White	1878	....	8.61	1.63	5.63	68.68	2.32	13.13	2.10	Do.

* Department seed.

ALALYSES OF AMERICAN SUGAR CORNS.

No.	Name.	Locality.	Date.	Weight of 100 kernels.	Water.	Ash.	Oil.	Carb-hydrates.	Fiber.	Albuminoids	Nitrogen.	Analyst.
				Grams.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	
18	Stowell's Evergreen	New England	1878		5.98	1.92	8.00	69.53	2.66	11.91	1.90	Department of Agriculture.
21	Golden	Massachusetts	1878		6.27	1.93	9.17	66.70	1.58	14.35	2.30	Do.
22	Marblehead Mammoth	do	1878		6.47	1.92	9.00	67.95	1.88	12.78	2.04	Do.
24	Proctor's	do	1878		10.13	1.92	7.95	66.17	1.75	12.08	1.93	Do.
1273	Black Sugar	E. Exper. Farm, Pa		27.392	8.50	1.90	8.88	65.81	3.53	11.38	1.82	Do.
1275	Darling's Sugar	do		21.635	7.80	1.95	9.08	67.64	3.03	10.50	1.68	Do.
1276	Egyptian	do		25.359	7.40	1.70	8.08	68.01	3.08	11.73	1.88	Do.
1277	Stowell's Evergreen	do		23.478	7.00	2.35	11.89	62.45	4.58	11.73	1.88	Do.
19	Egyptian	Maryland	1878		7.54	1.92	7.80	69.17	2.02	11.55	1.85	Do.
1220	Stowell's Evergreen	Department seed	1882	15.717	7.85	2.25	7.83	69.12	3.50	9.45	1.51	Do.
1221	Roslyn Hybrid	do	1882	24.319	7.85	1.75	8.77	66.41	5.24	9.98	1.60	Do.
1222	Early Minnesota	do	1882	29.251	9.50	2.10	9.12	65.56	3.14	10.58	1.69	Do.
1223	Egyptian	do	1882	16.475	8.10	2.15	7.96	68.05	3.76	9.98	1.60	Do.
1961	Sugar-corn	Kansas		16.501	10.76	1.90	8.06	65.85	3.10	10.33	1.65	Do.
20	Red River	Minnesota	1878		9.13	1.89	9.31	66.48	1.46	11.73	1.88	Do.
23	Prolific		1878		10.38	1.87	7.65	67.73	2.04	10.33	1.65	Do.
	Sweet	Connecticut	1877		9.45	2.06	9.13	63.05	1.93	14.38	2.30	S. W. Johnson.
	Stowell's Evergreen Sweet	do			10.86	1.89	7.66	65.86	2.63	11.10	1.61	W. O. Atwater.
	Mammoth Sweet	do	1878		9.43	1.93	7.48	66.09	2.75	12.32	1.98	S. W. Johnson.

AVERAGES.

From the preceding results averages have been calculated as in the case of wheats. The sugar corns are not included, as it will be seen that they are of quite a different composition from field corn, and should be, therefore, considered by themselves.

AVERAGE COMPOSITION OF AMERICAN CORN.

Locality.	Weight of 100 kernels.	Water.	Ash.	Oil.	Carbhydrates.	Fiber.	Albuminoids.	Nitrogen.	Largest weight of 100 kernels.	Smallest weight of 100 kernels.	Highest albuminoids.	Lowest albuminoids.	No. of analyses.	No. of weights of 100 kernels.	Analyst.
	Grams.	*Pr. ct.*	*Pr. ct.*	*Pr. ct.*	*Pr. ct.*	*Pr. ct.*	*Pr. ct.*	*Pr. ct.*	*Grams.*	*Grams.*	*Pr. ct.*	*Pr. ct.*			
America	36. 910	10. 04	1. 52	5. 20	70. 69	2. 09	10. 46	1. 67	52. 679	23. 605	13. 65	7. 00	114	61	
Northern States	37. 320	9. 98	1. 54	5. 11	71. 32	1. 41	10. 64	1. 70	44. 147	30. 610	13. 65	7. 53	30	3	
South	....	8. 96	1. 37	4. 94	72. 06	1. 72	10. 95	1. 75	....	....	11. 03	10. 88	2	....	
Middle West	32. 457	12. 33	1. 43	4. 97	68. 16	2. 22	10. 89	1. 70	....	....	12. 00	9. 29	15	1	
Far West	37. 528	9. 50	1. 55	5. 30	70. 75	2. 47	10. 43	1. 67	52. 679	28. 348	12. 75	8. 23	53	53	
Pacific Slope	27. 900	9. 78	1. 48	6. 40	72. 13	2. 07	8. 14	1. 30	....	....	8. 40	7. 88	2	1	
Mexico	....	9. 58	1. 58	5. 48	71. 34	1. 68	10. 34	1. 65	....	....	10. 67	10. 15	3	....	
New Hampshire	....	10. 10	1. 58	5. 48	70. 15	1. 11	11. 67	1. 85	....	....	13. 65	10. 50	11	....	Department of Agriculture.
Vermont	....	8. 64	1. 45	5. 63	72. 76	1. 38	10. 14	1. 62	....	....	....	....	1	....	Do.
Connecticut	....	10. 84	1. 54	4. 70	70. 98	1. 46	10. 48	1. 69	....	....	11. 63	9. 19	13	....	Johnson and Atwater.
Pennsylvania	37. 320	7. 96	1. 43	5. 22	74. 54	1. 97	8. 88	1. 42	44. 147	30. 610	10. 15	7. 53	5	3	Department of Agriculture.
North Carolina	....	8. 96	1. 37	4. 94	72. 06	1. 72	10. 95	1. 75	....	....	11. 03	10. 88	2	....	Johnson and Dept. of Agr.
Kentucky	32. 457	7. 70	1. 50	5. 33	73. 47	2. 20	9. 80	1. 57	....	....	....	....	1	....	Department of Agriculture.
Tennessee	....	7. 58	1. 23	5. 09	74. 16	2. 65	9. 29	1. 48	....	....	....	....	1	....	Do.
Indiana	....	11. 29	1. 28	4. 87	70. 16	1. 90	10. 50	1. 68	....	....	....	....	1	....	R. C. Kedzie.
Michigan	....	13. 20	1. 45	4. 95	67. 05	2. 21	11. 14	1. 73	....	....	12. 00	9. 88	12	....	Do.
Missouri	38. 411	8. 18	1. 68	5. 28	72. 00	2. 33	10. 54	1. 68	52. 679	30. 674	12. 78	8. 23	26	26	Department of Agriculture.
Kansas	33. 271	11. 94	1. 49	4. 87	69. 39	2. 16	10. 15	1. 62	36. 687	28. 348	10. 68	9. 10	6	6	Do.
Colorado	34. 120	10. 50	1. 50	5. 66	70. 19	2. 35	9. 80	1. 60	....	....	....	....	1	1	Do.
Texas	37. 833	10. 44	1. 42	5. 45	69. 52	2. 77	10. 40	1. 66	43. 799	30. 898	11. 03	9. 80	20	20	Do.
Oregon	....	9. 25	1. 46	7. 08	73. 07	1. 26	7. 88	1. 26	....	....	....	....	1	....	Do.
Washington Territory	27. 900	10. 30	1. 50	5. 73	71. 19	2. 88	8. 40	1. 34	....	....	....	....	1	....	Do.
Mexico	....	9. 58	1. 58	5. 48	71. 34	1. 68	10. 34	1. 65	....	....	10. 67	10. 15	3	....	Do.

The average American corn, as compared with the averages of foreign investigators, which, no doubt, include many of our corns, stands in quite a different position from wheat.

Averages of American corn compared with averages of foreign investigators.

Constituents.	Richardson.	Koenig.	Wolff.
Water	10.04	13.12	14.40
Ash	1.52	1.51	1.50
Oil	5.20	4.62	6.50
Carbhydrates	70.69	68.41	62.10
Fiber	2.09	2.49	5.50
Albuminoids	10.46	9.85	10.00
	100.00	100.00	100.00
Nitrogen	1.67	1.58	....

There is no marked difference between the averages, except in the matter of water, where, as in wheat, our grain is much drier. The American corn is rather better than the foreign article, if there is any difference.

In the averages for different sections of the country, another fact is discovered, which, after our experience with wheat, is still more surprising than the result of this comparison of American and foreign corns. There is apparently the same average amount of ash, oil, and albuminoids in a corn wherever it grows, with the exception of the Pacific slope, where, as with wheat, there seems to be no facility for obtaining or assimilating nitrogen. The amount of water is variable, but, as has been said, many of the samples had been on exhibition for a considerable time, and were consequently dried out. The increase in the fiber from east to west is not entirely paralleled in the wheat, but, as we have seen, is often a feature of increased vigor. Corn, is then, an entirely different grain from wheat. It maintains about the same percentage of albuminoids under all circumstances, and is not affected by its surroundings in this respect.

A study of the averages for each State shows that the samples from Pennsylvania and from Oregon and Washington Territory fall below the general average, and that those from New Hampshrie rise above it. The preponderance of averages for single States which do not vary one per cent., proves, however, that corn is much more stable in its composition than wheat, even though New Hampshire contains an extreme of 11.67 per cent. average albumen, and Pennsylvania, Oregon, and Washington Territory extremes of 8.88, 8.40,and 7.88 per cent. Only two analyses have been made from the Pacific slope, and more are needed for confirmation; but as the two analyses, like those of the wheats grown there, are low in albumen, this may safely be assumed to be characteristic of that portion of the country.

Having discussed the averages, it is of interest to see how wide the variations in composition are:

Variations or extremes for each constituent.

Constituents.	Highest.	Lowest.	Variation.	Above average.	Below average.
Water ....per cent..	15.10	7.40	7.70	5.06	2.64
Ash..........do..	2.10	1.18	.92	.58	.34
Oil..........do..	7.49	3.92	3.57	2.29	1.28
Carbhydrates..........do..	75.73	65.97	9.76	5.04	4.72
Fiber..........do..	3.10	.78	2.32	1.01	1.31
Albuminoids..........do..	13.65	7.00	6.65	3.19	3.46
Weight of 100 kernels..........grams..	52.679	23.605	29.074	15.769	13.305

The variation of water has been explained; that of ash is remarkably small, of oil and fiber proportionately the same as in wheat, while albumen has not nearly so wide a variation; and in fact in the analyses of the one hundred and fourteen corns, only three contain less than 8 per cent., two more than 13 per cent., and seven more than 12 per cent., so that the usual limits may be said to be between 8 and 12 per cent.; and this is true of the analyses of foreign maize grown by Koenig.

Our conclusion must be, then, that corn can supply itself with nitrogen under very varied circumstances, but that it rarely is able to assimilate more than a certain amount, nor will it fall far below this amount. The bushels of crops may vary and the size of the grain, but the quantity of albuminoids is practically unchanged. Under these circumstances it is perhaps needless to say that there is but slight variation in composition between different kinds of corn. Red Dent is slightly inferior, but the remaining varieties are practically of the same composition.

Sugar corn, however, is quite distinct from the field or hard corns. Its average composition, compared with the average of all the hard corns, shows a much higher percentage of oil, and somewhat higher ash, fiber, and albuminoids. The grain dries out more than field corn, and weighs less.

Average composition of sugar and hard corn.

Constituents, &c.	Sugar.	Hard.
Number of analyses..........	19	114
Water..........per cent..	8.44	10.04
Ash..........do....	1.97	1.52
Oil..........do....	8.57	5.20
Carbhydrates..........do....	66.72	70.69
Fiber..........do....	2.82	2.09
Albuminoids..........do....	11.48	10.46
Nitrogen..........do....	1.84	1.67
Weight of 100 kernels..........grams..	22.236	36.910

OTHER CEREALS THAN CORN AND WHEAT.

Sufficient analyses of other American cereals have not been made to determine what effect environment has upon them. From foreign analyses it is possible to calculate the variations which are usually found, and it is fair to suppose that as the agreement is close with corn and wheat, it would be so in the remaining cereals. For this purpose the large collection, by Koenig, of analyses of cereals has been employed. The analyses of each cereal are divided into percentages of the whole number made according to the amount of albuminoids they contain. It was

then found that of this number 75 per cent. would fall within certain limits, which might be regarded as the ordinary variation to be expected. The extremes are as follows:

Extremes of albuminoids in different cereals.

Cereal.	For all analyses.		For 75 per cent. of the analyses.	
	Highest.	Lowest.	Highest.	Lowest.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
Wheat	24	5	14	8
Barley	18	6	14	8
Oats	18	6	13.8	9
Rye	15	8	13	9.25
Corn	15	5	10.6	8.3

The probable variation in a wheat, therefore, is 6 per cent., barley 6 pet cent., oats 4.8 per cent., rye 3.75 per cent., and corn 2.3 per cent. Wheat and barley have the widest variation, followed by oats and rye, corn having the smallest.

It is apparent, then, that wheat and barley must be more dependent on their supply of nitrogen than corn, which coincides with the results of Atwater's field experiments with various fertilizers. He found that corn responded less than other cereals to nitrogenous fertilizers.

GLUTEN.

In a previous report determinations were published of the amount of gluten in thirty-three wheats grown in Colorado. From an average of these determinations it was found that the moist gluten was about 33.12 per cent. of the grain and the dry 11.74 per cent., and that the relation between the gluten and nitrogen was as 5.49 to 1, with extremes of 6.49 and 4.77. The following determinations have been made in some of the wheats at present reported upon:

Wheats from Colorado.					Seed from Department.				
Serial No.	Per cent. of nitrogen.	Per cent. of albuminoids.	Moist gluten.	Dry gluten.	Serial No.	Per cent. of nitrogen.	Per cent. of albuminoids.	Moist gluten.	Dry gluten.
786					785	2.18	13.65	37.05	14.51
788	2.02	12.60	32.74	12.87	787	1.88	11.72	24.24	10.15
790	1.90	11.90	28.62	11.57	789	1.76	11.03	24.29	9.27
792	2.32	14.53	33.61	13.16	791	2.02	12.60	23.48	9.16
794	2.18	13.65	36.42	13.19	793	2.24	14.00	34.35	13.27
796	1.99	12.43	33.58	12.35	795	2.49	15.58	46.17	17.19
798	1.96	12.25	32.55	11.86	797	1.57	9.80	9.67	3.82
800	1.99	12.43	37.79		799	1.76	11.03	19.88	8.08
802	2.27	14.18	45.26	15.54	801	2.32	14.53	38.66	13.99
804	1.85	11.55	26.29	10.16	803	1.93	12.08	25.84	9.78
806	2.38	14.88	40.95	15.06	805	2.66	16.63	47.57	17.83
808	2.02	12.60	36.90	13.18	807	2.02	12.60	36.35	12.83
Aver.	2.09	13.06	34.69	12.89	Aver.	2.07	12.94	30.63	11.66
Highest.	2.38	14.88	45.26	15.54	Highest.	2.66	16.63	14.57	17.83
Lowest.	1.85	11.55	26.29	10.16	Lowest.	1.57	11.03	9.67	3.82

Wheats from North Carolina.

Serial No.	Per cent. of nitrogen.	Per cent. of albuminoids.	Moist gluten.	Dry gluten.	Serial No.	Per cent. of nitrogen.	Per cent. of albuminoids.	Moist gluton.	Dry gluten.
811......	1.76	11.03	27.68	10.56	824......	1.62	10.15	23.98	9.18
812......	1.43	8.93	12.78	5.16	825......	1.90	11.90	30.55	11.55
813......	1.65	10.33	17.47	6.99	826......	1.48	9.28	17.62	7.12
814......	1.62	11.15	23.01	9.02	827......	1.54	9.63	18.31	7.18
815......	1.60	9.98	24.45	9.25	828......	1.82	11.38	27.32	10.63
816......	1.54	9.63	17.77	6.92	829......	1.96	12.25	32.49	12.05
817......	1.51	9.45	25.23	9.55	830......	1.99	12.43	32.39	12.38
818......	1.60	9.88	22.14	8.40	831......	1.60	9.98	22.18	8.74
819......	1.79	11.20	30.43	11.30					
820......	1.46	9.10	18.81	7.73	Aver ...	1.67	10.50	23.94	9.26
822......	1.71	10.68	23.00	9.54	Highest	1.99	12.43	32.49	12.38
823......	1.88	11.73	31.24	11.97	Lowest .	1.43	8.93	12.78	5.16

Wheat from Oregon.					Wheat from Virginia.				
Serial No.	Per cent. of nitrogen.	Per cent. of albuminoids.	Moist gluten.	Dry gluten.	Serial No.	Per cent. of nitrogen.	Per cent. of albuminoids.	Moist gluten.	Dry gluten.
772......	1.37	8.58	3.11	1.24	780......	2.24	14.00	37.41	14.01
773......	1.29	8.05	16.89	6.34	781......	1.62	10.15	11.37	4.39
774......	1.34	8.40	5.04	2.04	782......	1.85	11.55	26.39	11.66

Relation of gluten to nitrogen and of dry to moist gluten.

Description.	Dry gluten to nitrogen.	Dry to moist gluten.
	Per cent.	*Per cent.*
In Colorado wheat—1881	5.49	35.51
In Colorado wheat—1882	6.12	34.56
In seed sent to Colorado	5.63	38.07
In North Carolina wheat	5.54	38.68
In Oregon wheat	2.41	38.20
In Virginia wheat	5.22	39.98

The average gluten of the Colorado wheats of 1882 has improved over that in the seed furnished by the Department, although the average nitrogen is alike in both. This may, however, be due to the fact that many wheats after they have been preserved a year do not yield as much gluten as when they are fresh. This has been noticed in examination of the wheats grown in 1879 which we have had in hand this year, and for that reason determinations of gluten in these specimens have been omitted. As an example of the effect of time upon the gluten I have recently had some duplicate determinations made with wheats which had already been examined a year ago.

Duplicate determinations of gluten in wheats grown in 1882.

Serial No.	Made in 1882.		Made in 1883.	
	Moist.	Dry.	Moist.	Dry.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
752	29.12	10.54	23.39	9.51
753	26.12	9.26	22.61	9.19
754	19.76	7.05	.00	.00
756	23.45	7.80	10.70	4.17

The later determinations are seen to be the lowest, but there is much difference in the way varieties act. Number 753, for instance, loses but slightly, while it was found to be impossible by the most careful manipulation to extract any gluten from No. 754 after it had stood a year.

An explanation is thus furnished of the fact that No. 797 of the seed-wheats sent to Colorado has such an extremely low percentage of gluten. It had been preserved more than a year before the gluten was determined, and was a wheat which could not resist the action of time.

Examinations of wheats at intervals in this way will distinguish their keeping qualities, a matter of great importance. Among the flours analyzed and described elsewhere is one which, from its low percentage of gluten and abnormal relation to its nitrogen content, is shown to be without any ability to withstand the effects of storage for a long time. It may safely be said that if a wheat or flour is found whose gluten falls below four times its nitrogen it has been injured by storage or some other injurious action, and from our averages it is apparent that a good wheat should contain five and a half times as much gluten as nitrogen.

The North Carolina wheats contain the same relative amounts of nitrogen and moist and dry gluten as those from Colorado, and are in no way abnormal, but they show how low the gluten descends in our poorer eastern wheats. In the samples from Oregon and Virginia, on the contrary, the relations are very irregular. Those from Oregon are all extremely low, and only one within the limit of the necessary relation to the nitrogen. These wheats may have become injured, but it is more probable that it is an inherent peculiarity of the Oregon grain, for, as has been previously shown, the wheat from that State, at least as far as it has been examined, is quite different from any other with which we are acquainted. The specimens from Virginia are peculiar in that No. 780, the smallest wheat yet examined, weighing only 1.803 grams per 100 kernels, is quite normal in its gluten content, while No. 781, grown under slightly more advantageous conditions, directly beside it, is quite as abnormal. Something in the method of harvesting or preservation of the sample must be the cause of this, but the determinations would be sufficient to show that No. 780, small as it is, would be preferable for bread-making to No. 781.

It remains to speak of the crude gluten after it has been extracted from the wheat. It consists, as is well known, of the four principal nitrogenous constituents of the wheat, the fifth, albumen or cerealine, being washed away. In addition, there are present numerous impurities, including in the dry substance a small portion of water, which can only be removed at a high temperature, and some fat, starch, and fiber. To determine the relative amount of these substances the following analysis of an average sample of crude gluten has been made:

Composition of crude gluten dried at 100° *C.*

Water	3.97
Ash	2.90
Fat	4.97
Fiber	3.24
N.×6.25	74.19
Undetermined non-nitrogenous	10.73
	100.00

Only about 74 per cent. of the crude gluten is pure and the remainder impurities, if the pure gluten is supposed to contain 16 per cent of nitrogen. As there was 10.73 per cent. of the crude substance which was neither water, ash, fat, or fiber, and it seemed improbable this could all

be starch, the question arose as to whether the pure gluten did not contain less than 16 per cent. of nitrogen.

Ritthausen had suspected from his work that variations in the amount of nitrogen in the constituents of gluten was possible, and in order to decide this point a small amount of pure substance was made from flour and analyzed with the following result:

Ash-free gluten dried at 130° C contains 15.94 per cent. of nitrogen.

Six and twenty-five one-hundredths, then, is without doubt the proper factor to employ, and the undetermined 10.73 per cent. must consist of impurities. This amount of impurities is larger than that found by Ritthausen, but it seems to remain constant in all cases with the same method of manipulation as is shown by the small variation in the relation of the crude gluten to the nitrogen, and therefore does not a ffect the results as a means of comparison of wheats and judging of their milling qualities. It must merely be borne in mind that we are dealing with a crude, not a pure gluten.

The relation between nitrogen and gluten in wheats which we have found agrees very well with Ritthausen's figures, but the amount is lower, as we might expect from the inferior amount of nitrogen in our wheats. We found that the dry gluten averaged 14.38 per cent. or 5.64 times the nitrogen. His analyses show that the crude gluten which he obtained was rather purer than ours.

FLOUR AND BREAD.

The subject of flours and the bread produced from them has been very extensively considered on the continent of Europe, and nowhere has there been more attention given to it than in Hungary and in Vienna. In the reports of the United States Commissioners to the Vienna Exhibition of 1873, Prof. E. N. Horsford has given an extensive paper upon the subject.

In considering the immediate causes of heavy and light bread he shows that the gluten of the flour is the body whose tenacity and elasticity when in the dough enables it to hold the bubbles of gas which are formed in the process of rising, and that consequently a flour deficient in gluten cannot make a light bread. The gluten, however, when present in sufficient amount must be in such a physical condition as not to be injured and discolored by the fermentation which goes on in the dough through the action of the yeast. The methods of milling are of course responsible for the condition in which the gluten is left in the flour originally, but the length of time and manner in which the flour is stored and preserved have their ultimate effect upon it.

With a view to a study of the quality of some of our American flours in common use, and the breads and other products made from them, the following analyses have been made:

986–992. Breads, rolls, buns, and cakes from J. Seitz's bakery, Washington, D. C., purchased immediately after coming from the oven.

1135–1140. Flours used in making the previous breads, &c., and designated as follows:

1135. "Eagle Bluff." Illinois spring wheat.
1136. "Red River." Minnesota spring wheat.
1137. "Wife's Delight." Wisconsin spring wheat.
1138. "Richmond." Virginia winter wheat.
1139. "E. A. Schriver." Maryland winter wheat.
1140. "Red S." Ohio winter wheat.

1121–1122. Flour and bread made from it in the family of John Dugan. Received thirty-six hours after coming from the oven.

1177–1180. Flour and bran and white and Graham bread made therefrom. Purchased at Kraft's bakery, Washington, D. C.

1181–1182. 1194–1196. Flours, bread and biscuits from my own kitchen.

FLOURS AND BREADS.

Constituents.	986. Family loaf.	987. Graham loaf.	988. French rolls.	989. Beaten rolls.	990. Sweet buns.	991. Sugar-cakes.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Ash	1.86	1.80	1.91	1.55	2.15	.78
Fat	.95	1.00	3.41	5.65	6.18	11.30
Sugars, &c	3.45	4.37	4.29	5.21	10.89	27.60
Dextrine	4.55	4.90	4.10	3.64	4.37	2.01
Starch	75.00	72.87	71.69	68.94	64.40	46.83
Soluble albuminoids	1.90	3.01	3.44	1.56	2.64	2.60
Insoluble albuminoids	10.93	10.27	9.78	10.65	8.93	5.74
Fiber	1.36	1.78	1.38	2.81	.44	3.14
Nitrogen	2.05	2.12	2.11	1.96	1.85	1.33
Total albuminoids	12.83	13.28	13.22	12.21	11.57	8.34
Per cent. of crust	55.65	56.50	64.93	50.44	62.10	....
Water	37.30	37.88	32.24	24.21	26.99	8.79
Ash	1.17	1.12	1.29	1.17	1.57	.71
Fat	.60	.62	2.31	4.28	4.51	10.31
Sugars, &c	2.16	2.71	2.91	3.95	7.95	25.18
Dextrine	2.85	3.04	2.78	2.76	3.19	1.83
Starch	47.03	45.27	48.58	52.25	47.02	42.71
Soluble albuminoids	1.19	1.87	2.33	1.18	1.93	2.37
Insoluble albuminoids	6.85	6.38	6.63	8.07	6.52	5.24
Fiber	.85	1.11	.93	2.13	.32	2.86
Nitrogen	1.29	1.32	1.43	1.48	1.35	1.22
Total albuminoids	8.04	8.25	8.96	9.25	8.45	7.61

Constituents.	992. Molasses cakes.	1121. Bread, John D.	1122. Flour, John D.	1135. Eagle Bluffs Spring wheat.	1136. Red River Spring wheat.	1137. Wife's Delight Spring wheat.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Ash	2.38	2.56	.68	.90	.58	.46
Fat	4.37	1.09	1.09	1.52	1.23	1.32
Sugars, &c	36.08	4.69	1.36	2.17	2.34	1.85
Dextrine	3.56	6.42	4.14	2.19	1.18	1.76
Starch	45.19	73.29	79.65	79.00	81.43	83.17
Soluble albuminoids	.00	.92	2.90	2.90	2.61	3.39
Insoluble albuminoids	7.97	10.15	9.23	10.88	9.74	7.60
Fiber	.45	.88	.45	.43	.89	.45
Nitrogen	1.27	1.76	1.95	2.20	1.98	1.76
Total albuminoids	7.97	11.07	12.13	13.78	12.35	10.99
Water	10.22	30.32	12.00	12.30	13.55	12.40
Ash	2.14	1.79	.60	.80	.50	.40
Fat	3.93	.76	.96	1.33	1.06	1.16
Sugars, &c	32.39	3.27	1.64	1.90	2.02	1.62
Dextrine	3.20	4.47	3.64	1.92	1.02	1.54
Starch	40.57	51.07	70.08	69.29	70.40	72.86
Soluble albuminoids	.00	.64	2.56	2.54	2.26	2.97
Insoluble albuminoids	7.15	7.07	8.12	9.54	8.42	6.66
Fiber	.40	.61	.40	.38	.77	.39
Nitrogen	1.14	1.23	1.71	1.93	1.71	1.54
Total albuminoids	7.15	7.71	10.68	12.08	10.68	9.63

Constituents.	1138. Richmond Winter wheat.	1139. E. A. S., Indiana Winter wheat.	1140. Red S., Ohio Winter wheat.	1177. White loaf.	1178. Graham bread.	1179. Flour for 1177.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Ash	.62	.73	.73	1.75	2.81	.51
Fat	1.48	1.61	1.52	.52	1.22	1.37
Sugars, &c	1.86	1.74	1.80	2.44	5.73	1.97
Dextrine	1.84	2.30	2.34	5.20	4.80	2.36
Starch	82.22	82.89	80.62	75.82	69.53	78.93
Soluble albuminoids	4.79	2.33	3.83	2.02	1.88	2.24
Insoluble albuminoids	6.74	7.95	8.57	11.19	12.17	10.59
Fiber	.45	.45	.59	1.06	1.86	2.03
Nitrogen	1.84	1.64	1.99	2.11	2.25	2.05
Total albuminoids	11.53	10.28	12.40	13.21	14.05	12.83
Water	11.95	11.40	11.05	36.07	33.22	11.70
Ash	.55	.65	.65	1.12	1.88	.45
Fat	1.30	1.43	1.35	.33	.81	1,21
Sugars, &c	1.64	1.54	1.60	1.56	3.83	1.74
Dextrine	1.62	2.04	2.08	3.33	3.20	2.08
Starch	72.39	73.44	71.71	48.47	46.43	69.70
Soluble albuminoids	4.22	2.06	3.41	1.29	1.26	1.98
Insoluble albuminoids	5.93	7.04	7.62	7.15	8.13	9.35
Fiber	.40	.40	.53	.68	1.24	1.79
Nitrogen	1.62	1.46	1.76	1.35	1.50	1.82
Total albuminoids	10.15	9.10	11.03	8.44	9.39	11.38

Constituents.	1180. Bran for 1178.	1181. Biscuit, Wisery.	1182. Flour, Wisery.	1194. Biscuit, Wisery.	1195. Loaf, Wisery.	1196. Flour, Wisery.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Ash	.77	1.37	.45	.11	1.20	.55
Fat	5.58	3.61	1.49	5.08	4.74	1.21
Sugars, &c	7.21	4.27	1.55	3.88	3.42	2.17
Dextrine	3.69	6.80	2.02	8.55	8.89	2.30
Starch	59.27	71.73	81.55	68.47	68.88	80.89
Soluble albuminoids	1.86	1.47	3.58	1.35	1.75	2.74
Insoluble albuminoids	13.06	10.18	8.63	11.22	10.13	9.83
Fiber	8.56	.57	.73	1.34	.99	.31
Nitrogen	2.39	1.86	1.96	2.01	1.90	2.01
Total albuminoids	14.92	11.65	12.21	12.57	11.88	12.57
Water	8.50	33.40	11.10	34.69	32.94	9.55
Ash	.70	.91	.40	.07	.81	.50
Fat	5.11	2.41	1.32	3.32	3.18	1.09
Sugars, &c	6.60	2.84	1.38	2.53	2.29	1.96
Dextrine	3.38	4.53	1.80	5.58	5.96	2.08
Starch	54.23	47.77	72.50	44.72	46.19	73.16
Soluble albuminoids	1.70	.98	3.18	.88	1.18	2.48
Insoluble albuminoids	11.95	6.78	7.67	7.33	6.79	8.90
Fiber	7.83	.38	.65	.88	.66	.28
Nitrogen	2.18	1.24	1.74	1.32	1.27	1.82
Total albuminoids	13.65	7.76	10.85	8.21	7.97	11.38

The flours as a whole contain average albuminoids 10.69 per cent., and the difference between those from spring and winter wheats is small—10.65 per cent., winter and 10.79 per cent. spring. They may be said, as far as the analyses go, to be equally good. Considered in comparison

with Hungarian flours,the best known, they are low in albuminoids, but this might be expected from our previous experience with wheats. Taken by themselves, they show a rather wide variation, the highest having 12.08 percent., and the lowest 9.10 per cent., the greatest variation being among the spring wheats. The average seems to be as high as could be expected from the wheats which we have analyzed from the sections from which these flours came, there being always a slight falling off in the amount of nitrogen in the best flour from that in the grain.

In their other constituents the flours show a plain and marked decrease, as compared to the grain, in ash and fat, these two substances being contained in much larger amount in the outer coats of the grain which are removed than in the portion which forms the flour. The fiber for the same reason is, as we should expect, much smaller. The amount of starch necessarily increases proportionately as the other constituents diminish.

The average of all these flours is compared below with the analyses of Hungarian flours given by Horsford:

Constituents.	American.	1. Imperial Extra.	4. Roll-flour.	6. Bread-flour.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
Water	11.67	10.62	10.42	10.75
Ash	.54	.42	.59	.76
Oil	1.25			
Sugars	1.71			
Dextrine	1.79			
Starch	71.72	71.02	67.30	65.63
Soluble albuminoids	2.80			
Insoluble albuminoids	7.90			
Fiber	.62			
Total albuminoids	10.70	11.56	12.37	14.56

The original Hungarian wheat containing 14 per cent. of albuminoids and the average American certainly not more than 12 per cent., it appears that our flours are related to our wheat in fully as advantageous manner as the Hungarian, if they can be considered as corresponding either to the Imperial Extra or Roll flours, which seems allowable.

Kedzie and Atwater have analyzed twenty-eight flours from Michigan, Kansas, Minnesota, and Connecticut, and the results have been collected by Dr. Jenkins in the report of the Connecticut Agricultural Station for 1879.

Kedzie found that the flours from spring wheats contained more albuminoids than those from winter wheats, but the average for all varieties is very nearly the same as for the flours which we have analyzed:

	Per cent.
Kedzie's spring-wheat flour	12.58
Kedzie's winter-wheat flour	10.54
Average of twenty-eight flours	10.89
Average of Department of Agriculture flours	10.70

The flours are shown by Kedzie's analyses to be somewhat independent of the composition of the grain, but as a rule there is a greater or less loss of ash and albuminoids in the making of flour. His paper will be found in the Michigan Agricultural Report, 1877.

As has been said before, the condition of the nitrogen, or rather the amount present as gluten, has much to do with the quality of the flour for baking purposes. In the six flours from Mr. Seitz the gluten has been determined mechanically:

Gluten in flours.

No.	Name.	Nitrogen.	Albuminoids.	Moist gluten.	Dry gluten.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
1135	Eagle Bluff, Illinois spring	1.93	12.08	39.46	12.98
1136	Red River, Minnesota spring	1.71	10.68	7.32	2.80
1137	Wife's Delight, Wisconsin spring	1.54	9.63	24.89	10.30
1138	Richmond, Virginia winter	1.62	10.15	28.13	10.37
1139	E. A. Schriver, Maryland winter	1.46	9.10	25.14	9.92
1140	Red "S," Ohio winter	1.76	11.03	31.20	11.67
	Average	1.67	10.45	26.02	9.67

The Hungarian flours, according to Horsford, average 37 per cent. of moist gluten; so that ours, with the exception of that from Illinois spring wheat, are below the average. That from Minnesota wheat would certainly make a poor bread, and must have deteriorated by keeping. Kedzie's determinations of gluten in sixteen flours, having an average of 10.69 per cent. albumen, showed an average of only 10.72 per cent. of gluten, slightly better than in the Washington flours, but still low. Under these circumstances, the question arises: Can we have as good bread, that is to say, as light, porous, and palatable as the Vienna? Although Horsford sees no reason why we cannot, it seems to me that, while our wheats and consequently our flours remain so poor in gluten, we cannot, without particular care to find such a brand as the "Eagle Bluff," and even that would probably vary on every grinding.

In the analyses of different grades of Hungarian flour which were mentioned above the decrease in the amount of albuminoids in the higher grades is apparent. The difference between the flour and the "bran," which is mixed with it at the Kraft bakery, shows that the same is true in our mill products, and that the Graham bread contains the greater percentage of albuminoids, and the same would be found to be true in regard to the valuable ash constituents. It has been a mooted question for a long time whether this ought not to be avoided and whole flour preferred to that which has been so highly elaborated.

Recent experiments by Dr. Max Rübner, published in the Zeitschrift für physiologische Chemie, 1883, p. 45, seem to prove that, in addition to the argument in favor of white bread on account of its palatability and many other advantages, it is in fact much more thoroughly digested, and consequently is really cheaper, weight for weight, to the poor man than the bread made with unbolted flour. We can only hope, then, for an improvement in the character of our wheats, to add to their nitrogen content, and to improved methods of milling, which we are fast becoming possessed of, to make it possible to produce a flour with the largest amount of nitrogen in the higher grades, and at the same time with it in the best physical condition. Then we may expect to improve our breads.

CHEMICAL COMPOSITION OF BREADS, ETC.

The changes which take place in flour during its conversion into various forms of bread and cake is well illustrated in the analyses given in a previous table.

The amount of water in the numerous kinds analyzed extends from nearly 38 in the breads to 9 per cent. in the sugar-cakes, the beaten rolls and buns occupying a medium position. The amount of water, however, decreases very rapidly on exposure to the air, as the following determinations on a white and a Graham loaf and in some rolls of domestic make show:

WHITE LOAF FROM KRAFT'S BAKERY.

(Serial No. 1177.)

Date.	Weight.	Per cent. of total water lost.	Water in bread on day named.
On leaving bakery:	*Grams.*		
August 22	452	....	36.07
On exposure:			
August 23	422	18.39	31.51
August 24	390	38.04	25.90
August 25	379	44.77	23.75
August 26	364	53.98	20.60
August 27	....	....	....
August 28	346	65.01	16.47
August 29	333	73.00	12.91
August 30	326	77.27	11.35
August 31	323	79.12	10.52
September 1	318	82.17	9.12
September 6	307	88.97	5.86

After drying two weeks there had disappeared all but 11.03 per cent. of the original water, and the air-dry material only contained 5.86 per cent. of water.

GRAHAM LOAF FROM KRAFT'S BAKERY.

(Serial No. 1178.)

Date.	Weight.	Per cent. of total water lost.	Water in bread on day named.
On leaving bakery:	*Grams.*		
August 22	464	....	32.22
On exposure to air:			
August 23	440	15.58	29.55
August 24	412	33.77	24.75
August 25	403	39.61	23.07
August 26	384	51.95	19.27
August 27	....	....	....
August 28	369	61.69	15.99
August 29	355	70.78	12.68
August 30	350	74.02	11.43
August 31	346	76.62	10.40
September 1	338	81.82	8.28
September 6	323	85.06	4.02

BREAKFAST ROLLS.

(Serial No. 1194.)

Date.	Weight.	Per cent. of total water lost.	Water in bread on day named.
On leaving oven:	*Grams.*		
August 23	364	....	34.69
On exposure:			
August 24	328	28.50	27.44
August 25	314	39.59	23.17
August 26	293	57.00	18.77
August 27	....	....	....
August 28	277	68.88	14.08
August 29	266	77.59	10.53
August 30	261	81.55	8.81
August 31	259	83.14	8.11
September 1	259	83.14	8.11
September 6	256	85.51	7.03

The loaf-breads dry more thoroughly but do not lose their water as rapidly at first as the rolls. The rolls, it may be said, which were used in this experiment were eight in number from a pan of twenty, and were not broken apart during the course of exposure.

The changes of a chemical nature displayed are those which are already tolerably well known, namely, the conversion of some of the starch by fermentation into sugar and by baking into dextrine. The albuminoids which, in the flour, are soluble in alcohol, become insolu-

ble, showing that change has taken place in the gluten. The apparent increase in ash and fat is of course due to salt and butter or lard added in making the dough.

GRASSES.

In the summer of 1882 several letters were written requesting collections of *Phleum pratense* at various stages of growth, from different sections of the country. Unfortunately only one response was received and that from Indiana. These specimens, comprising a series from the time when the head had not made its appearance until the seed was partly developed, were analyzed, and the results are here given:

Constituents, &c.	Phleum pratense.				
	Department garden—first year's growth.				Indiana.
	484.	921.	934.	960.	1130.
Development	Head out	In bloom	After bloom	After bloom	Head not out.
Date cut	June 19	June 26	July 3	July 10	June 8.
Height	49. c. m.	76. c. m.	65. c. m.	75. c. m.	....
Ash	8.58	7.16	6.52	5.63	7.94
Fat	6.10	4.47	4.69	3.72	1.97
Nitrogen, free extract	47.22	50.03	51.79	55.39	49.93
Crude fiber	23.95	27.35	28.26	27.08	29.19
Albuminoids	14.15	10.99	8.74	8.18	10.97
Total nitrogen	2.26	1.75	1.40	1.27	1.75
Nitrogen as non-albuminoid	.39	.51	.25	.15	.18
Per cent. of nitrogen as non-albuminoid	17.3	29.1	17.9	11.3	10.3
Water	78.56	66.75	56.63	58.86	70.00
Ash	1.84	2.38	2.83	2.31	2.38
Fat	1.31	1.49	2.03	1.53	.59
Nitrogen, free extract	10.12	16.64	22.46	22.79	14.98
Crude fiber	5.14	9.09	12.26	11.14	8.76
Albuminoids	3.03	3.65	3.79	3.37	3.29

Constituents, &c.	Phleum pratense.				
	Indiana.				Maryland.
	1131.	1132.	1133.	1134.	949.
Development	Before bloom	In bloom	After bloom	Early seed	In bloom.
Date cut	June 15	June 26	July 6	July 16	July 4.
Height	....	....	....	....	....
Ash	7.64	7.05	6.63	5.95	4.93
Fat	2.27	2.18	2.55	3.74	4.22
Nitrogen, free extract	52.64	52.99	53.93	60.77	52.83
Crude fiber	29.65	32.26	31.32	24.70	30.43
Albuminoids	7.80	5.52	5.57	4.84	7.69
Total nitrogen	1.25	.88	.89	.78	1.23
Nitrogen as non-albuminoid	.28	.00	.032	.00	.15
Per cent. of nitrogen as non-albuminoid	22.4	.00	3.6	.00	12.2
Water	67.50	64.50	56.30	53.00	64.00
Ash	2.48	2.50	2.90	2.80	1.78
Fat	.74	.78	1.11	1.76	1.48
Nitrogen, free extract	17.11	18.81	23.57	28.56	19.02
Crude fiber	9.64	11.45	13.69	11.61	10.98
Albuminoids	2.53	1.96	2.43	2.27	2.74

The table also includes a specimen from old, worn-out soil in Maryland, and a series of the first year's growth of the grass from seed sown on garden soil in the grounds of the Department of Agriculture. In a previous report* analyses of series of Phleum from old sod in Washington and from New Hampshire are recorded. We have, then, data for a comparison of this grass under quite varied conditions of growth. While it was remarked that the Phleum from the poor soil of New Hampshire was much lower in the amount of albumen which it contained than that from the richer grounds of the Department, the conditions in Indiana have reduced this constituent to a still lower point, and in the forms in which the nitrogen occurs, the Indiana specimens are remarkable. In those from every other locality the amount of non-albuminiod nitrogen is quite large at all stages of growth, but in the specimens from the West it practically disappears entirely in the latter stages of growth. It is rather difficult to explain the causes of this variability, but it shows at any rate the changes in composition which are produced by environment. There is a probability that in this case the inadequate supply of nitrogen which the plant has had, as shown by the total amount present, has made it necessary that all should be utllized in the albuminoid form. In this series of specimens the general poverty is manifest also in the small amount of fat and the larger amount of fiber which is present.

The first year's growth of the plant does not present any marked variation from the older grass, while the single specimen from Maryland has produced a large amount of fiber and a low amount of nitrogenous constituents.

The first year's growths of *Dactylis* and *Lolium* have been examined in the same way as the *Phleum*.

[First year's growth.]

	Dactylis glomerata.			
	459.	1111. Green.	1112. Yellow.	1200.
Development: Head not out.				
Date cut	June 12.	July 15.	July 15.	Oct. 25.
Height	28. c. m.	....	....	....
Ash	11. 50	10. 52	10. 14	10. 95
Fat	6. 89	6. 86	5. 95	6. 50
Nitrogen, free extract	48. 06	46. 95	52. 37	47. 98
Crude fiber	20. 63	21. 64	22. 44	21. 24
Albuminoids	12. 92	14. 03	9. 10	13. 33
Total nitrogen	2. 07	2. 25	1. 46	2. 14
Nitrogen as non-albuminoid	. 15	. 39	. 18	. 54
Per cent. of nitrogen as non-albuminoid	7. 3	17. 3	12. 3	25. 2
Water	79. 50	72. 30	74. 60	68. 70
Ash	2. 36	2. 91	2. 58	3. 43
Fat	1. 41	1. 90	1. 51	2. 03
Nitrogen, free extract	9. 85	13. 00	13. 30	15. 02
Crude fiber	4. 23	6. 00	5. 70	6. 65
Albuminoids	2. 65	3. 89	2. 31	4. 17

*1881-1882, p. 551.

	Lolium italicum.				
	413.	460.	485.	978.	1199.
Development: Head not out.					
Date cut	June 2.	June 12.	June 19.	July 10.	Oct. 25.
Height	22. c. m.	31. c. m.	38. c. m.	....	25. c. m.
Ash	13. 24	12. 70	14. 06	13. 87	10. 87
Fat	6. 91	6. 36	6. 18	6. 53	5. 31
Nitrogen, free extract	45. 55	49. 69	45. 07	44. 50	47. 12
Crude fiber	15. 50	16. 99	17. 84	20. 65	22. 40
Albuminoids	18. 80	14. 26	16. 85	14. 45	13. 60
Total nitrogen	3. 01	2. 28	2. 69	2. 31	2. 17
Nitrogen as non-albuminoid	. 60	. 45	. 66	. 59	. 49
Per cent. of nitrogen as non-albuminoid	19. 9	19. 7	24. 6	25. 5	22. 6
Water	84. 00	82. 70	82. 30	78. 90	71. 60
Ash	2. 12	2. 20	2. 49	2. 82	3. 09
Fat	1. 10	1. 10	1. 09	1. 38	1. 51
Nitrogen, free extract	7. 29	8. 59	7. 98	9. 39	13. 58
Crude fiber	2. 48	2. 94	3. 16	4. 36	6. 36
Albuminoids	3. 01	2. 47	2. 98	3. 05	3. 86

As these grasses do not blossom during the first year, a more marked difference might be expected than in the case of the timothy. This has proved to be the case. In both, the amount of ash, fat, and nitrogen is larger in the first year's growth, the fiber is rather smaller; and the fiber and non-albuminoid nitrogen, instead of decreasing toward maturity, increase. The water in the fresh grasses does not differ in any marked degree. The changes are such as might be expected from our knowledge of the habits of growth of such plants.

Among the analyses of *Dactylis* are data for a comparison between two samples cut from the same plot, one of which was green and flourishing, and the other, growing on the edge of the plot, of yellowish tinge. The latter shows a marked decrease in its content of nitrogen, and that it had suffered from inability to assimilate this element. The analyses are interesting as an addition to our knowledge of the physiology of the grasses.

FRUITS AND VEGETABLES.

In the last annual report, 1881 and 1882, p. 555, a number of analyses of fruits and vegetables were published. These have been supplemented by the following, the samples having been collected as formerly, in the markets of Washington:

FRUITS AND VEGETABLES, JUNE 7.

	429. Asparagus.	430. Norfolk potatoes.	431. Early Rose potatoes.	432. String beans, "Pat."	433. Yellow banana.	334. Lemons.	435. Cucumbers.	436. Monarch strawberries.	437. Cauliflower.	438. Rhubarb stems.	439. Spinach.
Height	....	....	....	....	....	....	....	....	....	....	....
Diameter	....	....	....	....	....	....	....	....	....	....	....
Weight apiece	....	184.5	90.4	....	111.00	85.00	160.2	....	285.00	128.5	....
Portion	....	....	....	....	Interior.	Whole.	Whole.	....	....	....	....
Ash	8.70	4.31	4.03	7.76	3.42	4.43	12.09	6.52	8.86	12.76	25.66
Oil and acid	4.52	.62	.60	4.43	3.99	13.35	5.82	10.03	8.61	16.18	6.43
Nitrogen free extract	38.96	87.92	87.41	55.61	85.57	65.58	46.34	61.65	53.85	44.52	31.42
Crude fiber	13.15	1.23	2.36	13.89	2.83	7.29	14.30	12.20	11.07	15.18	8.82
Albuminoids	34.67	5.92	5.60	18.31	4.19	9.35	21.45	9.60	17.61	11.36	27.67
Total nitrogen	5.55	.95	.89	2.93	.67	1.50	3.43	1.53	2.81	1.81	4.42
Non-albuminoid nitrogen	2.39	.31	.31	1.39	.10	.86	1.82	.25	.98	1.03	1.65
Per cent. total nitrogen as non-albuminoid	43.0	32.6	34.8	47.4	14.9	57.3	53.1	16.3	34.9	56.9	37.3
Free acid	.23	Trace.	.09	.54	.41	6.98	.55	.48	.63	7.25	.19
Water	94.02	77.61	79.69	91.00	66.25	88.38	96.29	93.97	90.82	92.67	92.42
Ash	.52	.96	.82	.70	1.15	.51	.45	.39	.81	.94	1.94
Oil and acid	.27	.14	.12	.40	1.35	1.55	.22	.60	.79	1.19	.49
Nitrogen free extract	2.33	19.69	17.75	5.00	28.88	7.62	1.72	3.72	4.94	3.26	2.38
Crude fiber	.79	.28	.18	1.25	.96	.85	.53	.74	1.02	1.11	.67
Albuminoids	2.07	1.32	1.14	1.65	1.41	1.09	.79	.58	1.62	.83	2.10

FRUITS, ETC., JUNE 13.

	465. Sharpless strawberries.	466. Monarch strawberries.	467. C. Downing strawberries.	468. Asparagus, large white.	469. Asparagus, small green.	470. Potato onion.	471. Pineapple.	472. May Duke cherries.	1173. Egg plant.	1174. Sweet potato.	1175. Lima beans.	1176. Evergreen sweet-corn.
Height	....	....	....	16.00	15.00	45.00	29.00	....	17.00	....	....	....
Diameter	....	....	....	....	....	....	10.00	....	14.00	....	....	....
Weight apiece	7.08	6.05	4.04	1.08	1.03	122.00	671.00	3.02	1113.00	295.00	1.06	347.00
Portion	....	....	....	....	....	....	....	....	....	....	(*)	(†)
Ash	6.12	6.52	7.39	15.22	9.23	3.64	3.25	4.18	7.04	2.31	5.37	3.54
Oil and acid	11.29	11.34	9.93	3.50	4.30	1.86	2.41	6.04	4.40	1.27	2.18	5.84
Nitrogen free extract	65.13	60.48	57.58	45.42	41.99	83.40	86.90	80.17	61.47	90.09	64.36	72.93
Crude fiber	7.15	12.96	16.34	10.18	13.62	5.39	3.84	1.71	10.85	2.10	5.43	2.72
Albumen	10.31	8.70	8.76	25.68	30.86	5.71	3.60	7.90	16.24	4.23	22.66	14.97
Total nitrogen	1.65	1.39	1.40	4.11	4.93	.91	.57	1.26	2.59	.67	3.62	2.40
Non-albuminoid nitrogen	.68	.35	.34	2.27	2.25	.30	.36	.76	1.19	.20	.74	.54
Per cent. of total nitrogen as non-albuminoid	41.2	25.2	24.3	55.2	45.5	33.0	63.2	60.3	45.9	29.8	20.4	22.5
Free acid	.64	.58	.22	....	.24	.09	.63	.65	.09	Trace.	....	.04
Water	90.21	93.25	91.63	93.61	94.25	86.48	89.28	86.10	92.93	71.51	68.46	81.25
Ash	.60	.44	.62	.97	.53	.49	.35	.58	.50	.66	1.69	.66
Oil and acid	1.10	.77	.83	.23	.25	.25	.26	.84	.31	.36	.69	1.10
Nitrogen free extract	6.38	4.08	4.82	2.90	2.42	11.28	9.31	11.14	4.34	25.67	20.30	13.67
Crude fiber	.70	.87	1.37	.65	.78	.73	.41	.24	.77	.60	1.71	.51
Albumen	1.01	.59	.78	2.64	1.77	.77	.39	1.10	1.15	1.20	7.15	2.81

*Seed immature. †Kernel immature.

The methods of analysis have been improved by providing a steam drying chamber, furnishing a rapid current of air at 60° C., which dries the fruits in a short space of time without bringing about those changes which are inevitable in drying in a closed space at higher temperatures or more slowly in the sun. The amount of free acid has been determined in the analyses at present published, as it is an important element in the fruit, and, in addition, should be estimated to furnish a knowledge of the actual fat in the ether extract.

The analyses of several varieties of strawberries show the very slight difference which there is between them, consisting principally in the amount of fiber present and in the much smaller amount of acidity in the Charles Downing.

Three varieties of asparagus are all distinguished for the large amount of nitrogen which they contain, as might be expected in such very young shoots, and for the large proportion in the amide form. The ash, too, is rather high and variable.

The banana is remarkable from the fact that it contains more nitrogen free extract, consisting, probably, largely of starch than any fresh vegetable.

In the dry substance of the cucumber the nitrogen runs up to a high percentage, as do the non-albuminoid forms in which it exists, but owing to the extremely large percentage of water it is not so manifest in the fresh vegetable.

The attention of the casual reader, unacquainted with the composition of foods of this sort, is called to the large amount of water which all vegetables contain. In devouring a pound of an ordinary fruit one secures less than two ounces of solid substance.

The remaining analyses demand no further explanation. That of lemons is to be considered as a substitute for the analysis previously published, which is incorrect in many respects, owing to the manner of drying. In a more extended way the following analyses of melons have been carried out, that is to say, with the different portions of the fruit dried and analyzed separately:

FRUITS (PULP AND JUICE).

	Gypsy watermelon.				Nutmeg melon.				
	1160. Rind.	1161. Pulp.	1162. Seeds.	1163. Juice.	1164. Rind.	1165. Pulp.	1166. Pulp juice.	1167. Seeds.*	1168. Interior juice.
Per cent. of whole	55.78	6.87	2.24	35.11	40.49	3.99	46.32	3.27	5.44
Length ... c. m.	32.4	......	......	......	......	......	......	....	......
Diameter ... do	21.0	......	......	......	15.0	......	......	....	......
Weight of melon ... grams	6,203.	......	......	......	1,163.0	......	......	....	......
Ash ... per ct.	12.38	4.06	2.60	2.88	7.66	6.32	5.91	....	13.66
Fat ... do	3.54	8.81	7.02		5.67	4.99			
Nitrogen free extract .. do	55.75	69.22	50.67	95.43	69.67	73.87	88.83	....	73.99
Crude fiber ... do	14.01	6.79	24.19		9.92	9.05			
Albumen ... do	14.31	11.12	15.52	1.63	6.99	5.77	5.23	....	12.35
Total nitrogen ... do	2.29	1.78	2.48	.259	1.12	.92	.834	....	1.98
Non-alb. nitrogen ... do	1.60	1.23	.26	......	.45	.46	......	....	......
Per cent. of total nitrogen as non-alb. ... per ct.	69.9	69.1	10.5	......	40.3	50.0	......	....	......
Water ... do	89.97	91.87	48.37	93.05	91.15	76.44	90.53	....	92.61
Ash ... do	1.24	.33	1.34	.20	.68	1.49	.56	....	1.01

* Not analyzed.

FRUITS (PULP AND JUICE)—Continued.

	Gypsy watermelon.				Nutmeg melon.				
	1160. Rind.	1161. Pulp.	1162. Seeds.	1163. Juice.	1164. Rind.	1165. Pulp.	1166. Pulp-juice.	1167. Seeds.*	1868. Interior juice.
Fat ....per cent.	.36	.72	3.63	6.632	.50	.18	8.41	.....	5.47
Nitrogen free extract..do..	5.59	5.64	26.16		6.17	17.40			
Crude fiber............do..	1.41	.55	12.43		.88	2.13			
Alubmen..............do..	1.43	.89	8.01	.113	.62	1.36	.50	.....	.91
Total nitrogen ....do..	.230	.145	1.280	.018	.099	.216	.079	.....	1.46
Non-alb. nitrogen .....do..	.161	.100	.134	....	.040	.108	....	.....	......
Per cent. of total nitrogen as non-alb.......per ct..	70.0	69.0	10.5	....	40.4	50.0	....	.....	......

* Not analyzed.

ANALYSES OF VEGETABLES AT DIFFERENT STAGES OF DEVELOPMENT.

Analyses of a number of vegetables at different stages of development have been made from specimens collected in the gardens of the Department. They show plainly the changes which the plants undergo, although there is always difficulty in collecting specimens which represent an unbroken series.

DEWING'S BLOOD TURNIP BEET.

With one exception the plants have been divided into roots and tops. They were large and well-developed.

DEWING'S BLOOD TURNIP BEET.

	Entire plant.	Tops.							
	416. June 2.	443. June 9.	492. June 19.	914. June 26.	943. July 3.	973. July 10.	1124. July 24.	1144. Aug. 15.	1212. Oct. 25.
Height or length ....c.m..	25.	9.	36.	27.	33.	35.	30.	26.	......
Average weight of one..grams.	....	12.5	30.0	49.8	147.5	111.5	104.7	54.0	27.0
Ash ....per cent.	28.82	26.38	24.41	26.47	25.50	23.65	25.13	23.50	21.14
Fat ....do..	5.45	6.29	5.29	5.46	4.37	4.48	4.90	5.54	44.23
Nitrogen free extract......do..	35.04	33.36	41.25	40.39	45.28	43.30	44.21	42.71	4.77
Crude fiber ....do..	7.21	8.38	7.54	8.55	7.81	8.24	7.72	8.18	8.42
Albumen ....do..	23.48	25.59	21.51	19.13	17.04	20.33	18.04	20.07	21,44
Total nitrogen ....do..	2.74	4.10	3.44	3.06	2.73	3.25	2.88	3.21	3.43
Nitrogen as non-alb.......do..	1.11	1.17	.91	.87	.80	.86	1.02	1.21	1.04
Per ct. nitrogen as non-alb.do..	29.7	28.6	26.6	28.4	29.3	26.5	35.4	37.7	30.4
Water ....do..	90.12	90.04	91.91	89.57	92.63	85.51	81.93	87.83	81.97
Ash........................do..	2.85	2.63	1.97	2.76	1.88	3.43	4.54	2.86	3.81
Fat ....do..	.54	.63	.43	.57	.33	.65	.88	.67	.76
Nitrogen free extract.....do..	3.46	3.32	3.34	4.21	3.34	6.27	7.98	5.20	8.07
Crude fiber ....do..	.71	.83	.61	.89	.56	1.19	1.41	1.00	1.52
Albumen ....do..	2.32	2.55	1.74	2.00	1.26	2.95	3.26	2.44	3.87

DEWING'S BLOOD TURNIP BEET—Continued.

	Roots.							
	444. June 9.	493. June 19.	913. June 26.	944. July 3.	972. July 10.	1123. July 24.	1143. Aug. 15.	1211. Oct. 25.
Height or length........c. m.	....	9.	5.2	....	....	....	.4	....
Breadth........do..	....	....	....	5.4	6.5	6.5	5.4	6.5
Average weight of one......grams.	2	6.4	21.7	64.5	95.0	49.29	74.0	130.
Ash........per cent..	12.16	9.43	7.37	7.21	7.81	6.25	7.88	10.64
Fat........do..	2.46	1.67	2.00	1.34	1.11	1.06	.71	1.35
Nitrogen free extract........do..	63.87	77.21	76.41	77.77	73.39	76.51	75.16	67.91
Crude fiber........do..	7.70	5.79	5.31	6.68	5.67	4.39	4.93	6.09
Albumen........do..	13.81	5.90	8.91	7.00	12.02	11.09	11.32	14.01
Total nitrogen........do..	2.20	.95	1.42	1.11	1.93	1.77	1.82	2.24
Nitrogen as non-albuminoid...do..	1.11	.03	.91	.49	1.20	1.28	1.29	1.47
Per ct. of nitrogen as non-alb..do..	50.5	3.3	64.2	44.3	62.2	72.3	70.9	65.7
Water........do..	87.04	86.80	83.40	86.69	87.80	83.03	85.33	89.46
Ash........do..	1.58	1.24	1.22	.96	.95	1.18	1.16	1.12
Fat........do..	.32	.22	.33	.18	.14	.18	.10	.14
Nitrogen free extract........do..	8.27	10.19	12.69	10.35	8.95	12.98	11.03	7.16
Crude fiber........do..	1.00	.77	.88	.89	.69	.75	.72	.64
Albumen........do..	1.79	.78	1.48	.93	1.47	1.88	1.66	1.48

The tops or leaves are seen to exceed in weight the roots until August, when the former transfer their substance to the latter and prepare to wither. In the tops the ash is much larger at all times, although in the roots it increases steadily. The same may be said of the fat, except that it decreases relatively in the roots. The fiber in the tops varies in no regular manner. In the roots it decreases until the very last specimen, and even in this it is somewhat smaller in amount in the fresh beet. The nitrogen is rather irregular in both leaves and roots, but although falling in the middle of summer, increases toward the maturity of the plant. The non-albuminoid forms of this constituent are much more plentiful in the roots, and greater in amount late in the season. The water in the plant varies much. The leaves dry out in October and the roots absorb moisture. In fact the activity in the root is large as the season of growth ends. It is plainly storing up material for the next season's growth.

EARLY LONG ORANGE CARROT.

This root crop has been analyzed in the same way as the beet.

CARROT.

	Entire plant.	Tops.							
	415. June 2.	449. June 9.	494. June 19.	910. June 26.	947. July 3.	971. July 10.	1118. July 20.	1157. Oct. 15.	1205. Oct. 26.
Height or length .....c. m.	26.	(?)	27.	28.	28.	37.	38.	42.	36.
Av. weight of one ..grams.	(?)	(?)	3. 1	9.	46.	51.	65.	116.	257.
Ash ....per ct.	23. 95	20. 69	18. 06	17. 45	16. 16	18. 06	16. 97	17. 18	16. 92
Fat ....do..	4. 61	2. 65	4. 27	5. 52	4. 97	4. 37	4. 23	5. 07	4. 67
Nitrogen free extract..do..	41. 82	44. 89	48. 77	46. 46	51. 45	51. 08	51. 85	53. 93	50. 56
Crude fiber..............do..	6. 48	8. 12	7. 57	9. 65	8. 50	8. 17	8. 38	8. 60	11. 47
Albumen ....do..	23. 14	23. 65	21. 33	20. 92	18. 92	18. 32	18. 57	15. 22	16. 38
Nitrogen...............do..	3. 95	3. 79	3. 41	3. 35	3. 03	2. 93	2. 97	2. 43	2. 62
Water ....do..	85. 10	85. 70	82. 10	81. 60	81. 70	83. 40	81. 80	83. 40	85. 40
Ash.......................do..	3. 57	2. 96	3. 23	3. 21	2. 96	3. 00	3. 09	3. 20	2. 47
Fat ....do..	. 69	. 38	. 76	1. 01	. 91	. 73	. 77	. 94	. 68
Nitrogen free extract..do..	6. 23	6. 42	8. 73	8. 55	9. 41	8. 43	9. 44	10. 03	7. 38
Crude fiber..............do..	. 96	1. 16	1. 36	1. 78	1. 56	1. 35	1. 52	1. 60	1. 68
Albumen ....do..	3. 45	3. 38	3. 82	3. 85	3. 46	3. 04	3. 38	2. 83	2. 39

	Roots.							
	450. June 9.	495. June 19.	909. June 26.	948. July 3.	970. July 10.	1117. July 20.	1156. Oct. 15.	1206. Oct. 25.
Height or length...............c. m.	(?)	11.	29.	(?)	30.	30.	30.	51.
Breadth ....do..	....	....	....	1. 5	2. 5	3. 0	3. 4	9. 6
Average weight of one .....grams.	. 4	. 94	16	18. 2	38	74	157	697
Ash...............................per ct.	22. 17	13. 13	12. 21	11. 09	10. 45	10. 10	9. 88	10. 26
Fat.....................................do..	3. 78	6. 07	2. 71	4. 64	3. 61	5. 17	3. 21	4. 56
Nitrogen free extract...........do..	57. 78	57. 13	67. 85	62. 11	71. 11	67. 55	68. 39	58. 33
Crude fiber.........................do..	5. 37	13. 77	7. 87	12. 27	7. 13	8. 91	7. 98	11. 76
Albumen ....do..	10. 80	9. 90	9. 36	9. 89	7. 70	8. 27	10. 54	15. 09
Nitrogen..............................do..	1. 73	1. 59	1. 49	1. 59	1. 23	1. 32	1. 69	2. 41
Water.................................do..	88. 40	88. 20	87. 40	87. 70	87. 30	87. 50	84. 30	86. 80
Ash.....................................do..	2. 57	1. 55	1. 54	1. 36	1. 33	1. 26	1. 55	1. 34
Fat.....................................do..	. 44	. 72	. 34	. 57	. 46	. 66	. 50	. 62
Nitrogen free extract. ....do..	6. 71	6. 74	8. 55	7. 64	9. 03	8. 44	10. 74	7. 70
Crude fiber ....do..	. 62	1. 62	. 99	1. 51	. 90	1. 11	1. 25	1. 55
Albumen ....do..	1. 26	1. 17	1. 18	1. 22	. 98	1. 03	1. 66	1. 99

It is much like the preceding plant in its manner of growth, but the roots contain more ash than the beet in the earlier periods, and more fat at all times. The nitrogen free extract, too, is smaller in amount. In the nitrogenous constituents there is not a great difference, and the leaves do not seem to have suffered so much depletion in the later stages.

ONIONS—GIANT DELLA ROCCA.

The specimens of onions which were collected for analyses were un fortunately dwarfed in size by lack of cultivation and proper thinning out early in their growth. The measurements show the bulbs to be small:

ONIONS (*Grant della rocca*).

	Entire plant.			Tops.			Bulbs.		
	414. June 2.	480. June 15.	902. June 23.	928. June 29.	977. July 10.	1120. July 20.	927. June 29.	976. July 10.	1119. July 20.
Height or length......c. m.	14.	35.	35.	36.	29.	30.	....	....	....
Breadth...............do..	....	....	....	....	....	....	....	3.7	4.0
Av. weight of one..grams.	....	4.	....	....	....	....	3.	15.	30.
Per cent. of part....per ct.	....	....	....	77.4	54.6	37.8	22.6	45.4	62.2
Ash..................do..	21.78	10.17	15.93	15.00	15.14	16.85	10.67	9.35	9.61
Fat..................do..	6.14	7.21	7.93	6.81	5.69	2.17	6.66	6.39	5.49
Nitrogen free extract..do..	39.64	50.21	41.04	38.25	48.00	49.57	56.55	61.48	57.55
Fiber.................do..	10.21	12.25	15.75	18.82	10.99	12.83	13.62	10.54	9.77
Albumen...............do..	22.23	20.16	19.35	21.12	20.18	18.58	12.50	12.24	17.58
Total nitrogen.........do..	3.56	3.22	3.10	3.38	3.23	2.97	2.00	1.96	2.81
Nitrogen as non-alb...do..	1.09	1.03	.86	1.09	1.03	1.52	....	.91	1.44
Per ct. total n. non-alb..do..	30.6	32.0	27.7	32.2	31.9	51.2	....	46.4	51.2
Water.................do..	89.79	90.71	91.13	91.48	91.18	90.30	91.05	87.19	93.52
Ash...................do..	2.22	.94	1.41	1.28	1.34	1.64	.95	1.20	.62
Fat...................do..	.63	.67	.70	.58	.50	.21	.60	.82	.36
Nitrogen free extract..do..	4.05	4.67	3.64	3.26	4.23	4.81	5.06	7.87	3.73
Fiber.................do..	1.04	1.14	1.40	1.60	.97	1.24	1.22	1.35	.63
Albumen...............do..	2.27	1.87	1.72	1.80	1.78	1.80	1.12	1.57	1.1

The analyses show that, as in other biennials of this nature, which store a large part of their nourishment for the second year's growth in the root or corm, the tops gather large amounts of ash, fat, and nitrogenous substance, which, later in the growth of the plant, are transferred to the root. In this variety the amount of non-albuminoid nitrogen in the root is large, but not as much so as in some specimens examined previously.

All the measurements which have been given in these and other analyses, as well as the weights, are in the metric system.

Cabbage and lettuce.

CABBAGE (HENDERSON.)

Constituents, &c.	Entire head.				Interior.
	419. June 2.	908. June 26.	942. July 3.	966. July 10.	1146. Oct. 15.
Height or length..........c. m..	29.	33.	30.	30.	
Average weight of one..........grams..	....	*466.	549.	†925.	436.
Ash..........per ct.	29.49	20.18	19.32	16.59	981.
Fat..........do..	5.77	5.51	5.27	4.34	4.32
Nitrogen free extract..........do..	33.27	40.53	45.61	45.28	50.47
Fiber..........do..	8.11	10.48	11.09	12.07	9.42
Albumen..........do..	23.96	23.30	18.71	21.72	25.98
Total nitrogen..........do..	3.73	3.72	2.99	3.47	4.15
Nitrogen as non-albuminoid..........do..	1.20	1.63	.50	1.48	2.63
Per cent. of total nitrogen as non-albuminoid..........do..	32.2	43.8	16.8	42.7	63.4
Water..........do..	88.39	87.39	86.01	87.46	94.31
Ash..........do..	3.43	2.55	2.70	2.08	.56
Fat..........do..	.67	.69	.74	.54	.24
Nitrogen free extract..........do..	3.86	5.11	6.38	5.69	2.87
Fiber..........do..	.94	1.32	1.55	1.51	.54
Albumen..........do..	2.71	2.94	2.62	2.72	1.48

* Beginning to head. † Well set.

LETTUCE.

Constituents, &c.	Entire plant. 400. May 18.	420. June 2.	447. June 9.	915. June 26.	941. July 3.	1101. July 14.	Stem. 1128. July 28.	Leaves. 1129. July 28.
Breadth ....c. m..	....	....	....	17.	31.	60.	85.	....
Average weight of one ....grams..	1.	....	96.	256.	266.	287.	287.	....
Per cent. of part ....per cent..	....	....	....	....	....	....	41.08	58.02
Ash ....do..	26.46	47.52	21.08	19.62	16.55	14.40	10.23	12.49
Fat ....do..	5.32	4.19	6.80	6.84	8.04	7.02	5.64	6.91
Nitrogen free extract ....do..	32.08	24.35	40.70	31.30	33.09	44.39	53.32	45.36
Fiber ....do..	9.86	7.80	8.25	15.51	17.36	12.84	23.23	18.70
Albumen ....do..	26.28	16.14	23.17	26.73	24.96	21.35	7.58	16.54
Total nitrogen ....do..	4.20	2.59	3.71	4.27	3.99	3.41	1.21	2.65
Nitrogen as non-albuminoid ...do..	2.22	.92	1.16	2.13	1.77	1.25	.57	.56
Per cent. of total nitrogen as non-albuminoid ....grams..	52.8	35.5	31.3	49.9	44.4	36.6	47.1	21.1
Water ....per cent..	94.39	90.06	95.02	94.59	94.31	91.50	88.46	86.28
Ash ....do..	1.49	4.72	1.05	1.06	.94	1.22	1.18	1.71
Fat ....do..	.30	.42	.34	.37	.46	.60	.65	.95
Nitrogen free extract ....do..	1.80	2.42	2.03	1.69	1.88	3.77	6.15	6.22
Fiber ....do..	.55	.78	.41	.84	.99	1.09	2.68	2.57
Albumen ....do..	1.47	1.60	1.15	1.45	1.42	1.82	.88	2.27

These analyses show that both of the plants are very highly nitrogenous, have very little fiber, much oil and ash, and the smallest amount of nitrogen free extract. Non-albuminoid nitrogen is present at all periods of growth in quite large amount. In the cabbage it decreases at first, afterwards increasing, and in the interior of the head, when the crop is gathered, is unusually large.

NON-ALBUMINOID NITROGEN IN DECIDUOUS TREES AND IN THE CONIFERÆ.

The universal presence of non-albuminoid nitrogen in the vegetables which have been analyzed made it of interest to see in what way trees, both deciduous and evergreen, were related to this form of nitrogen. Analyses have been made of the leaves of *Acer dasycarpum* and *Abies excelsa* at intervals in their growth.

SPRUCE NEEDLES.

Constituents.	440. June 1.	441. June 6.	482. June 16.	905. June 23.	951. July 6.	1110. July 15.	1156. Aug. 16.	1197. Oct. 20.
Ash ....per cent..	3.40	4.18	4.04	4.37	2.85	4.55	5.01	5.37
Fat ....do..	15.35	12.12	10.57	11.24	11.84	9.36	10.18	10.33
Nitrogen free extract ....do..	49.84	52.38	44.94	48.14	49.02	53.45	49.94	50.66
Crude fiber ....do..	16.99	20.94	32.04	27.37	22.14	24.91	27.38	23.97
Albumen ....do..	12.42	10.38	8.41	8.88	9.15	7.73	7.49	9.67
Total nitrogen ....do..	1.99	1.66	1.34	1.42	1.43	1.24	1.20	1.55
Nitrogen as non-albuminoid	.26	.21	.16	.19	.22	.10	.08	.23
Per cent. of nitrogen as non albuminoid........ per cent..	13.1	12.7	11.8	13.4	15.1	8.1	6.7	14.8
Water ....do..	80.60	77.00	75.40	71.60	67.20	64.30	68.70	56.70
Ash ....do..	1.05	.96	.99	1.24	.94	1.63	1.57	2.32
Fat ....do..	2.98	2.79	2.60	3.19	3.88	3.34	3.20	4.47
Nitrogen free extract ....do..	9.67	12.05	11.06	13.68	16.08	19.08	15.64	21.94
Crude fiber ....do..	3.29	4.82	7.88	7.77	8.90	8.89	8.57	10.38
Albumen ....do..	2.41	2.38	2.07	2.52	3.00	2.76	2.42	4.19

MAPLE LEAVES.

Constituents, &c.	481. June 16.	906. June 23.	950. July 6.	1103. July 15.	1159. Aug. 16.	1198. Oct. 20.
Ash .... per ct.	5.73	6.82	5.95	6.35	8.47	8.44
Fat .... do..	18.17	17.48	17.08	12.70	12.18	20.80
Nitrogen free extract .... do..	45.63	47.99	52.50	56.58	54.68	49.46
Crude fiber .... do..	13.34	9.80	8.41	7.37	10.40	10.83
Albumen .... do..	17.13	17.91	16.16	17.00	14.27	10.47
Total nitrogen .... do..	2.74	2.87	2.59	2.72	2.28	1.68
Nitrogen as non-albuminoid .... do..	.29	.41	.33	.25	.26	.13
Per cent. of nitrogen as non-albuminoid .... do..	10.6	14.3	12.7	9.2	11.4	7.7
Water .... do..	67.50	68.10	62.30	73.50	75.70	69.40
Ash .... do..	1.86	2.17	2.24	1.68	2.05	2.58
Fat .... do..	5.90	5.57	5.11	3.37	2.96	6.37
Nitrogen free extract .... do..	14.82	15.34	19.79	15.00	13.29	15.14
Crude fiber .... do..	4.34	3.12	3.17	1.95	2.53	3.31
Albumen .... do..	5.58	5.70	6.09	4.50	3.47	3.20

The results show a small amount of the nitrogen in non-albuminoid form, pointing to the conclusion that the amides do not play as important a part in the large as in the smaller plants. In both series there is a decrease in the end of July, and increase in October, somewhat as has been found in grasses.

THE SOTOL. *Dasylirion Texanum.*

This interesting plant was brought to the attention of the division in February, 1882, by Messrs. Green and Siebert, of New York, who obtained it from a correspondent, "who had lately bought a large tract of land in the western counties of Texas, near the Rio Grande River," and found upon it "a very large number of a plant called there sotol, the shape somewhat of a very large pineapple or a large cabbage."

Sheep are said "to be very fond of this sotol and thrive upon it," and "it is said to contain sugar." "The plains covered by it look like a vast cabbage-field, and sheep feeding upon it go without water for many weeks." "The Mexicans use it to make a sort of liquor, and, it is supposed, to be owing to the sugar it contains."

In reply to a request for further information and specimens, an entire plant was forwarded to the Department, and the following account of its uses:

Of the sotol only the bulb is used as feed. The shepherd carries a large knife with which he splits the bulb, of which the interior is soft, and readily eaten by sheep. After getting accustomed to its use there is no necessity for the knife, the sheep being able to pull off the sharp outside leaves, and reach the softer and more palatable portion of the bulb. Sheep fed on it can do without water in the winter for four or five months. The Mexicans eat it, and prepare it for use as follows: They make an excavation large enough to hold six or eight solot stocks, and a large fire having been made in the hole, the ground is thourougly heated. Then all is taken out but a bed of live coals at the bottom, upon which the sotol is placed and covered with earth. After remaining for ten or twelve hours it is taken out, and presents a brown juicy appearance, and has a sweet taste. It grows abundantly in Western Texas and Mexico on a rocky and gravelly soil, and prospers in the driest seasons. After roasting it is fermented and distilled, and sold under the name "sotol mescal," possessing very intoxicating properties. It is a favorite beverage of the lower class of Mexicans.

From the leaves they gain a very strong fiber, which is used in making ropes, sacks, &c.

From the specimens forwarded, the plant proved to be *Dasylirion Texanum*, which is characterized as follows in Watson's Revision of the North American Liliaceæ:*

D. Texanum Scheele. Caudex 2 to 5 feet high, bearing a dense rosette of leaves, and flowering stem 8 to 10 feet long; leaves light green, 3 or 4 feet long, 4 or 5 lines broad below and attenuate upward, splitting into coarse fibers at the apex, the serrulate margin armed with hooked teeth a line long and 3 to 6 lines apart; the dilated base narrowed gradually into the leaf, entire; panicle 2 to 3 feet long, very narrow; the partial panicles erect or suberect, and about 3 inches long, equaling the broad subtending bracts; racemes an inch or two long, ascending; floral bractlets broadly ovate, acute, lacerately toothed, about a line long; perianth a line long; fruit 3 to 3½ lines long, on pedicels a line long, broadly elliptical, the rather narrow wings continued above and adnate to the style (or attenuate apex of the body) its whole length; seed (immature), 1½ inches loug, acute at both ends. Lumaea, 23, 140. *D. graminifolium*. Baker Trim. Journ., Bot., 10, 279. Mainly W. Texas, Eastern New Mexico.

This description gives an idea of the appearance of the whole plant, but it is only the "dense rosette" of leaves at the summit of the caudex which is of economic value. The exterior of this portion of the plant is formed of the bases of leaves which have, to a large extent, passed away. They are blackened and hard, whereas on their removal the bases of the interior leaves of a newer growth are yellow or yellowish white, shining, and to a certain degree succulent. They are closely appressed to the flowering stem.

The head under examination weighed 2,954 grams, or about 6½ pounds. The interior soft portion weighed 920 grams, or 31 per cent. of the whole. From this, by means of a press, 38.3 per cent. of juice was obtained, having a specific gravity of 1.1404, and containing 32 per cent. of solids. With Fehling's solution there were found to be present substances of a reducing nature equivalent to—

	Per cent.
Glucose	.66
Sucrose	26.44

In the outer hard and dry portion there was still sufficient water to furnish 16.4 per cent. of juice having a specific gravity of 1.212, and containing 46.2 per cent. of solids, and after adding 50 per cent. of water to the bagasse a juice was expressed containing just the water employed and 17 per cent. of solids, and having a specific gravity of 1,073. The first of these juices reduced Fehling's solution in the equivalent of—

	Per cent.
Glucose	4.53
Sucrose	37.70

and the more dilute in the equivalent of—

	Per cent.
Glucose	1.16
Sucrose	15.44

which together make an equivalent of about 18 per cent. of sugar from the outer husks. In the interior more than 10.5 per cent. exists, and in the whole head probably more than 15.5 per cent. of sugars.

The sugars have been mentioned for convenience as glucose and sucrose, but that there is none of the latter substance appears from the fact that no crystals can be obtained from the juice on defecation and careful evaporation, even on standing a year, and because the juice polarizes 30° to the left, characterizing it at once as a new sugar, as there is no sugar with such a rotatory power which does not reduce

*Proc. Amer. Acad., Vol. XIV, p. 249.

Fehling's solution before inversion. The possibility of the presence of a glucoside arises, and this leads one to examine with interest the observations of Dr. Oscar Loew upon the true mescal, including several agave species. He found that the leaves of the unopened head were roasted by the Indians in a way similar to that which has been described for the sotol, and that a fermented drink or mescal was made from it. An analysis showed the presence of no starch, and this is the case with *Dasylirion*, and that the sugar which abounded in the plant was a glucoside, readily converted into glucose and citric acid. In many other respects there is an agreement in the composition and applications of the two plants. The quantity of material at our disposal has prevented a more complete examination of the nature of the glucoside present in the sotol, but the following preliminary proximate analysis has been made:

Analysis of Dasylirion Texanum—soft interior of head.

	Per cent.
Fresh substance contains water	65.00
The air-dry substance—	
Water	4.17
Ash	4.23
Ether extract (oil, &c.)	3.30
Resins, &c., insoluble in water, soluble in 80 per cent. alcohol	2.50
Sugars, &c., soluble in 80 per cent. alcohol and water	31.54
Gum	3.04
Undetermined	26.72
Crude fiber	16.44
Crude albumen (N. × 6.25)	8.06
	100.00

As a fiber-plant the sotol may be of a certain value in the countries in which it grows, but owing to the shortness of the cells it can be of no commercial importance.

As a food-plant, in the more or less desert districts, it is without doubt of great value, but beyond its native growth it will probably never be a prominent source of subsistence for man or animals.

MISCELLANEOUS WORK.

A large amount of the time of the division has been employed in work of an extremely miscellaneous character. The results which are of any general interest have been collected for publication in the following form:

NATURAL FERTILIZING MATERIALS.

BAT GUANO.

A bat guano from M. M. Dyer, Mountain Home, Ark., is a valuable deposit, similar to many which have been found throughout the southwest portion of the United States. It contains—

	Per cent.
Nitrogen	9.09
Equivalent to ammonia	12.13
Phosphoric acid	6.65
Equivalent to phosphate of lime	14.52

Its value would be approximately $50 per ton on the basis of valuation of commercial fertilizers in use in the Agricultural Experiment Stations.

Another bat guano from D. G. Bushnell, Saint Louis, Mo., contains—

	Per cent.
Nitrogen	5.78
Equivalent to ammonia	7.73
Phosphoric acid	8.80
Equivalent to phosphate of lime	19.21

This would have an approximate value of $140 per ton.

FLORIDA MUCK.

A muck from the Florida Keys, which is said to occur there in great abundance, was brought to the Department by Lieut. Kossuth Niles, U. S. N. An examination showed it to be made up largely of the spicules of sponges and organic matter derived from the same source. It contains, as received at the laboratory—

	Per cent.
Moisture	7.05
Organic matter	46.19
Inorganic matter soluble in acid	6.09
Inorganic matter insoluble	40.67
	100.00

In the condition in which it is collected it probably contains a very large amount of water, which, however, can be readily got rid of by allowing heaps of the material to dry upon the shore before hauling upon the land.

The organic matter contains—

	Per cent.
Nitrogen	3.53

The inorganic matter contains—

	Per cent.
Phosphoric acid	.60

The deposit is undoubtedly of local value, and has been found to produce good results in market gardening.

FLORIDA MOSS.

From Tampa, Fla., a specimen of rotten Florida moss (*Tillandsia usneoides*) has been received to determine its value in composts. The material as it reached us contained—

	Per cent.
Water	70.50
Dry matter	29.45
	100.00

The dry moss consisted of—

	Per cent.
Organic matter	56.13
Ash	43.87
Nitrogen in organic matter	1.17
Phosphoric acid P_2O_5 } in the ash	?
Potash K_2O } in the ash	?2.35

The moss is therefore of no greater value than any ordinary material of vegetable growth.

FLORIDA MARL.

Throughout the whole State there are numerous marl beds from which a great many samples have been sent to the Department and analyzed. As a rule they consist simply of carbonate of lime with greater or less percentage of sand or other insoluble matter. Now and then, however, a deposit of some value is found. In the past year two have been analyzed, one of which containted about 13 per cent. of phosphoric acid and another from C. J. Schoonmaker, Sanford, Orange County, Florida, 2.86 per cent.

The amount of phosphoric acid gives these deposits some local value, especially the first.

FLORIDA PEATS.

Four samples of peats, with following designations, given by C. Delano Spring Garden, Fla., have been analyzed:

1038. Hummock Swamp No. 1.
1039. Bay Head Muck No. 2.
1040. Savannah Muck, first layer.
1041. Savannah Muck, second layer.

As received they contained the following—

Constituents.	1038.	1039.	1040.	1041.
Water	52.83	46.97	66.32	56.82
Solid matter	47.17	53.03	33.68	43.18

The dry peats contain the following—

Constituents.	1038.	1039.	1040.	1041.
Nitrogen, N	2.43	1.57	2.16	2.80
Phosphoric acid, P_2O_5	None.	.136	.186	.114
Potash, K_2O	Trace.	Trace.	Trace.	Trace.

The mineral matter or ash consists of the following—

Constituents.	1038.	1039.	1040.	1041.
Total ash	9.61	9.45	8.86	17.04
Soluble in water	2.58	.63	2.86	2.40
Soluble in acid	3.86	1.19	2.61	9.23
Insoluble	3.17	7.63	3.39	5.32

The above results calculated to the peats as received are:

Constituents.	1038.	1039.	1040.	1041.
Nitrogen	1.15	.83	.73	1.21
Phosphoric acid	None.	.072	.063	.049
Ash soluble in water	1.22	.33	.96	1.08
Ash soluble in acid	1.82	.63	.88	3.99
Ash insoluble	1.50	4.05	1.14	2.30
Total ash	4.54	5.01	2.98	7.37

ASH OF COTTON-SEED HULLS.

This ash, from Louisiana, was found to contain—

	Per cent.
Phosphoric acid P_2O_5	6.58
Potash K_2O	24.50

It would be worth at least $28 a ton as a fertilizer.

WASTE PRODUCTS.

CORN WASTE.

A sample of moist corn waste, left after the removal of the starch from the grain, gave the following result on analysis:

Constituents.	Fresh.	Dry.
Water	64.73	....
Ash	2.03	5.77
Oil	7.20	20.40
Soluble albuminoids	3.05	8.64
Glucose	.15	.42
Dextrine	1.88	5.33
Starch isomers	12.54	35.56
Crude fiber	2.11	5.99
Insoluble albuminoids	6.31	17.89
	100.00	100.00

There were traces of acid in the waste, but no ferments were visible under the microscope. No starch could be detected with iodine, but in boiling one hour with 5 per cent. acid 24 per cent. of the dry substance was converted to glucose. Quite a large amount of material must exist, as appears in the analysis, in a form intermediate between starch and glucose.

GLUCOSE WASTE.

Three samples of waste from the manufacture of glucose at the Chicago Sugar Refinery have been analyzed at the request of Arno Behr.

No. 1092. "Hulls of corn dried."
No. 1093. "Germs dried and ground."
No. 1094. "Gluten, &c., dried."

Constituents.	1092.	1093.	1094.
Water	9.60	4.60	11.90
Ash	1.14	1.60	.68
Oil	5.25	40.69	3.77
Nitrogen free extract	65.58	34.52	62.07
Crude fiber	6.18	4.24	.58
Albumen	12.25	14.35	21.00
	100.00	100.00	100.00

All the specimens had an acid reaction, and contained a little starch. No. 2 is of value for the oil which it contains, and No. 3 as a substitute for cotton-seed meal.

More detailed proximate analyses are of some interest, showing, as they do, the presence of many transition products.

Constituents.	1092.	1093.	1094.
Water	9.60	4.60	11.90
Ash	1.14	1.60	.68
Oil	5.25	40.69	3.77
Soluble albuminoids	4.90	4.39	14.53
Phlobaphenes	5.38	.00	.00
Glucose	8.46	.40	.83
Amyloses (maltose)	7.64	.00	.00
Non-sugars soluble in 80 per cent. alcohol	8.95	.00	.00
Undetermined	32.83	31.92	58.08
Crude fiber	6.18	4.24	.58
Insoluble albuminoids	7.35	9.96	6.47
	100.00	100.00	100.00

RICE.

A specimen of rice from J. R. Sample, Summit, Miss., has the following composition:

Water	11.15
Ash	.90
Oil	.86
Soluble albumen	.44
Insoluble albumen	7.26
Glucose	.93
Soluble starch	2.64
Starch by difference	75.02
Crude fiber	.80
	100.00

ANALYSIS OF POA ARACHNIFOLIA, ELLIS COUNTY, TEXAS.

Weight of fresh clump of grass	grams..	202.
Weight of air-dry grass	do....	83.
Per cent. of air-dry grass		40.6
Consisting of:		
	Per ct.	Per ct.
Roots	(26.2)	63.9
Tops	(14.4)	36.1
	(40.6)	100.0

The air-dry tops contain—

Water	4.46
Ash	11.10
Crude fat	3.54
Nitrogen free extract	40.28
Crude fiber	30.47
Albumen	10.15
	100.00

AMERICAN WINES.

Four wines from the White Elk Vineyards, Keokuk, Iowa, were examined with results as follows:

No. 1. Norton's Virginia	1874
No. 2. Ives	1874
No. 3. Concord	1874
No. 4. Clinton	1874

Constituents.	1.	2.	3.	4.
Per cent. alcohol by weight	9.29	9.29	8.86	6.29
Per cent. alcohol by volume	11.52	11.52	11.00	7.83
Extractive matter	2.57	2.22	2.15	1.81
Ash	.49	.20	.20	.20
Total acid as tartaric	.946	.740	.710	.710
Volatile acid as acetic	.331	.231	.211	.173
Fixed acid as tartaric	.444	.384	.384	.444
Specific gravity	1.00168	.99832	.99732	.99795
Grape sugar	None.	None.	None.	None.

TANNIN.

A specimen of *Rhus Osbeckii* var. *semialata* from R. H. Foster, Babylon, Long Island, examined for tannin, contained 3.31 per cent. The determination was made by the improved Löwenthal method, and shows the sample to be of no value for tannin purposes.

WATERS.

During the past year a large number of waters of various characters have been analyzed, among them twelve remarkably strong mineral waters from Texas.

One from J. H. Stallings, Meridian, Tex., contained 757 grains of solid matter to the United States gallon, consisting of soluble silica, chlorides, sulphates, and carbonates; lime, magnesia, potash, and soda, with traces of other substances.

A water from Thomas J. Middleton, Grand View, Tex., contained 44.32 grains per gallon, largely carbonate and sulphate of iron.

Three spring-waters and one well-water, from W. J. Rosborough, Marshall, Tex., were of a chalybeate nature, containing also sulphate of lime and chlorides. The solids amounted to—

Spring No. 1, 181.37 grains per United States gallon.
Spring No. 2, 143.23 grains per United States gallon.
Spring No. 3, 208.54 grains per United States gallon.
Well No. 4, 604.64 grains per United States gallon.

They were evidently of similar origin.

Two waters from Sewell Slack, Walder, Tex., contained—

535 grains per United States gallon.
668 grains per United States gallon.

They were both from wells, and the solid matter consisted of potash, soda, lithia; the alkaline earths lime, strontia, and magnesia; iron and alumina as chlorides, sulphates, carbonates, and soluble silicates.

Two well-waters from Isaac Roberts, Hico, Tex., were strong brines containing a large amount of chlorides of soda and potash, and small amounts of sulphates and carbonates of lime and magnesia. The solid matter amounted to—

Well No. 1, 408 grains per United States gallon.
Well No. 2, 651 grains per United States gallon.

Another chalybeate water was received from D. Richardson, Baird, Tex., and contained of solid matter 489 grains per United States gallon.

This consisted of carbonates and sulphates of iron, lime, magnesia, and soda; also chlorides and soluble silicates.

A sulphur water from W. Fitzroy Stafford, Elmo, Tex., was of an inky black color, smelling strongly of sulphurets of hydrogen; it contained 249 grains per United States gallon, consisting of chlorides and car

bonates of iron, lime, magnesia, soda, and also soluble sulphates and silicates. The color was due to the sulphide of iron held in suspension.

In many of these waters the presence of lithia was quite marked.

KAOLINS.

Four kaolins from the Cecil County Kaolin Company of Maryland have been analyzed:

I. Crude buff.
II. Crude white.
III. Washing buff.
IV. Washing white.

Constituents.	I.	II.	III.	IV.
Silica, SiO_2	77.03	77.39	46.63	46.56
Alumina, Al_2O_3	16.08	15.54	37.73	38.16
Iron oxide, Fe_2O_3	1.08	.75	1.72	1.08
Lime, CaO	Traces.	Traces.	Traces.	Traces.
Magnesia, MgO	.13	.14	....	....
Potash, K_2O	.48	.45	....	....
Water, H_2O	5.93	5.96	13.96	14.35
	100.73	100.23	100.04	100.15

The effect of washing is plainly shown to be the removal of a large amount of silica or sand. The more hydrous clay remains together with the oxide of iron in the original earth.

The chemists who have assisted in the preceding analyses are entitled to much credit for the large amount of delicate work which they have accomplished with such successful results. I am especially indebted to Mr. Edgar Richards, Mr. A. E. Knorr, Mr. Miles Fuller, and Mr. William P. Wheeler, for their assistance in the investigation of wheat and corn.

Respectfully,

CLIFFORD RICHARDSON,
Assistant Chemist.

Hon. GEO. B. LORING,
Commissioner.

REPORT OF THE STATISTICIAN.

SIR: I have the honor to present the twentieth annual report of the Division of Statistics, it being my fifteenth annual report as Statistician.

With increase of facilities the work has taken a broader scope; with a higher popular appreciation of the uses of statistics, it is less difficult to obtain accurate information, and with increasing experience in the collection and co-ordination of essential facts, more reliable and suggestive results are obtained. It is gratifying to be able to report positive progress towards higher accuracy and utility in the collection and presentation of the agricultural statistics of the country.

The publication of results of the Tenth Census, first in fragmentary bulletins, or in special reports, then as a compendium of the whole, and now, by order of Congress, in completed quarto volumes, opens a mine of information, not only concerning products made in a given year, and (for the first time) the area on which these products were grown, but also in relation to the composition of local soils, the influence of climate on production, the distribution of the various crops under cultivation, the progress of practical forestry, and many other important points in the development of American agriculture.

Commercial organizations are acquiring statistical experience, and aiding in tracing the shipment and destination of surplus products. Their record of prices, compared with values on the farm, affords the means of determining the cost of handling and moving crops.

The spirit of statistical inquiry is abroad in the land. Publicists and statesmen are becoming imbued with it, newspapers have caught the inspiration, and pleas and sermons find forceful illustration through its influence.

These are all evidences of a higher popular appreciation of the uses and utilities of statistics, and at the same time assurances of a farther reach and superior accuracy in the work. It is well known to statisticians that in the past the greatest bar to efficiency in census work was found in the ignorance, the indifference, or the actual opposition of individuals from whom primary data must be obtained. Man, in the individuality and selfishness of his wild or savage state, has not learned to yield gracefully something of his natural rights to the general welfare of the community, and his partly-civilized brother is much inclined to resent as an impertinence the well-meaning and even beneficent attempts of the statistical inquirer. He is suspicious, and fears a tax levy if the inquirer is a Government official, and some economic disadvantage if he is a fellow-craftsman. It is wonderful to observe the lingering of some such prejudice in the minds of multitudes of no little intelligence and a degree of culture. It is gratifying to see these mists of ignorance and prejudice disappearing in the brightening light of the practical culture of the present day.

Yet this popularizing of statistics presents aspects both ludicrous and serious. Statisticians spring up like mushrooms in every avenue

of publicity, and by appropriation of results of organized work and the unfounded assumption of original effort, make an exhibit that is fraudulent in its method rather than inaccurate in its estimates. Others, equally unscrupulous, with an eye to gain, distort facts to affect the markets, to elevate and depress prices, from gambling considerations. This cannot be prevented; the gambling spirit pervades the trading marts of the country; but the great body of consumers and honest middlemen should question sharply the efforts of all interested parties who aim to mold public opinion through printed circulars and the public press. They should learn to discriminate between the true and the false, and to discount the statements that are manufactured to affect the market. These remarks apply only to statistics deliberately made for the purposes of dishonest gain. To assume that such practices are unknown would be the height of confiding simplicity. Nor is it strange that in the eager hunt for news reputable public news-gatherers should inadvertently accept the statements of interested persons concerning crop production.

All national, State, and impartial and competent private crop-reporting systems should be welcomed to this important field of investigation, and appreciated in exact accordance with their facilities and results. But there should be no toleration of pretense or fraud, for which there is a fruitful and remunerative field, and in which, unfortunately, there is likely to be no lack of workers.

The development of enterprise of this baneful sort has been especially marked within the last two years, with reference to several important crops. Corn, the most valuable of all crops of the country next to grass (pasturage and hay), has been systematically and persistently misrepresented, placed 30, 40, and even 50 per cent. above possible production, making a pretense of three hundred, five hundred, and sometimes eight hundred million bushels above the largest crop ever grown, which was never more than seventeen hundred millions, while the average for ten years past has been but about twelve hundred millions, and the present domestic requirement for consumption between fourteen and fifteen. A fictitious supplement to any sane or honest estimate, equal to the whole volume of maize grown in Southern Europe, is deliberately added to the highest reasonable aggregate, and presented with an assumption of profound sincerity and confidence that is calculated to deceive the unwary and unintelligent.

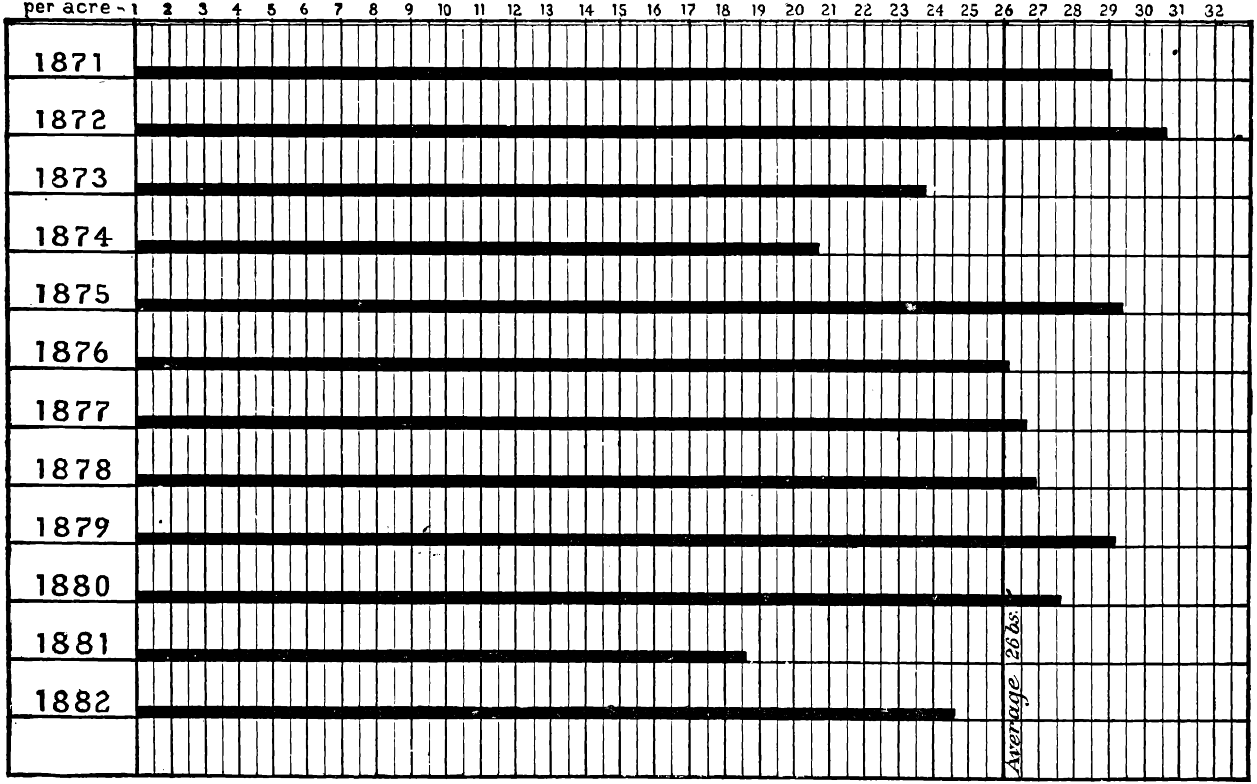
It is the province of official statistics to protect the producer and consumer, by an accurate forecast of crop production, against the speculator, who would confiscate the profits of the farmer and reduce the bread supply of the poor without giving the pretense of an equivalent. Many millions of dollars have been already saved from this piracy by official crop reports.

CROP ESTIMATES OF 1882.

The preliminary estimates of quantity of the principal crops growing in 1882 were published in the annual report of 1881–'82. A careful and laborious revision of the work of the year, and the tabulation for permanent record, was made later, including, with estimate of quantity, the area cultivated, the yield per acre, and the value per bushel, pound, or ton, and the total valuation for each State. These tabulations, uniform with those of previous years, are published here to continue and complete the data for future reference.

The year 1882 was one of nearly average fruitfulness, contrasting fa-

A.– Diagram showing the Annual Variation in yield of Corn of the U. S



vorably with the comparative failure of the previous season. The aggregate product, area, and value of cereals (corn, wheat, oats, barley, rye, buckwheat) is thus compared:

Years.	Product.	Area.	Value.
	Bushels.	*Acres.*	
1880	2,718,193,501	120,926,286	$1,361,497,704
1881	2,066,029,570	123,388,070	1,470,957,200
1882	2,699,394,496	126,568,535	1,468,693,393

This makes the average yield of all cereals 22.5 bushels in 1880, 21.3 in 1882, and only 16.7 in 1881. Yet, the aggregate farm valuation was greater in the year of lowest production than in the year of greatest abundance. This is in accordance with the law of supply and demand; 1880 was preceded by seasons of large supply and possessed large surplus stocks, but 1882, with nearly as much production, followed a year of scarcity, high prices, and depleted stocks. The figures of valuation show the natural effect of product upon price. The average value per bushel was 50.1 cents in 1880, 71.2 in 1881, and 54.4 in 1882. In the latter year this average is increased by the greater proportion of wheat to corn. In 1881 both wheat and corn were reduced in nearly equal degree.

CORN in 1882 was not an average crop, the yield being 24.6 bushels per acre, while the average of eleven preceding years was 26 bushels. During this period there were only three crops of lower yield, those of 1873, 1874, and 1881. There were six in succession, 1875 to 1880, between 26 and 29 bushels. These crops had unquestionably much to do with the recovery from the period of monetary depression and the return to specie payments.

The accompanying diagram (A) shows the comparative yield per acre of the entire breadth of corn during the past twelve years, and puts a quietus upon the wild assumption made by speculators last fall, who desired to buy maize at a low rate, that the crop was far above an average one, in fact, one of the largest in yield per acre, and by far the largest in the aggregate ever produced in the United States. The average of the estimates of eleven preceding years is thus compared with last year:

Period.	Average value per bushel.	Average yield per acre.	Average value of product per acre.
1871-'81	43.1	26.0	$11.20
1882	48.4	24.6	11.91

The yield is 5.4 per cent. less than the average of the period, and the price is 12.3 per cent. higher than the average price. This is a reasonable, indeed a necessary, difference, from two causes—first, the low surplus of stocks from 1881; and second, the tendency, through panic and speculation, to make the increase of price greater than the deficiency of product.

The spring of 1882 was late, wet, and cold, and corn-planting was delayed and replanting a necessity too general for the comfort of the corn-grower. There was much despondency during May, but June weather was more favorable, rains thereafter seasonable, and the summer temperature, though moderate, was long continued, so that a pro-

duction within about 5 per cent. of an average was obtained in quantity, with quality also below average. Drought prevailed in the Northern Atlantic coast; otherwise there was a quite general prevalence of favorable atmospheric conditions for the development of the crop.

The distribution of the growth of 1882 was somewhat abnormal. There was a marked decrease in the seven corn-surplus States, the region of commercial corn. Compared with the crop of 1879, in which 68.5 per cent. of the whole was produced in these States, the proportion of 1882 was 59.1 per cent., as shown in the following table, indicating the progress of maize production in the corn-surplus belt:

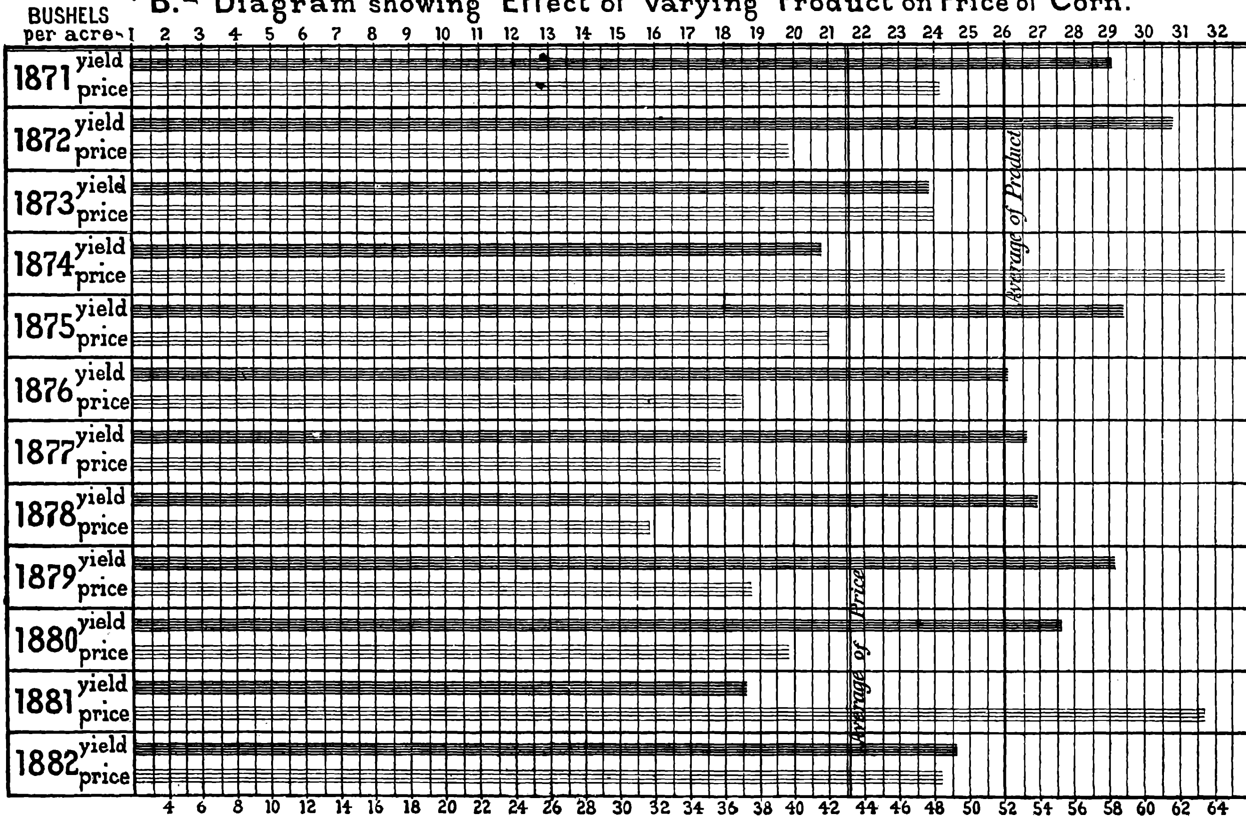
States.	1849.	1859.	1869.	1879.	1882.
	Bushels.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
Ohio	59, 078, 695	73, 543, 190	67, 501, 144	111, 877, 124	93, 319, 200
Indiana	52, 964, 363	71, 588, 919	51, 094, 538	115, 482, 300	107, 484, 300
Illinois	57, 646, 984	115, 174, 777	129, 921, 395	325, 792, 481	182, 336, 900
Iowa	8, 656, 799	42, 410, 686	68, 935, 065	275, 024, 247	175, 487, 600
Missouri	36, 214, 537	72, 892, 157	66, 034, 075	202, 485, 723	170, 037, 000
Kansas		6, 150, 727	17, 025, 525	105, 729, 325	144, 452, 600
Nebraska		1, 482, 080	4, 736, 710	65, 450, 135	82, 478, 200
Total	214, 561, 378	383, 242, 536	405, 248, 452	1, 201, 841, 335	955, 595, 800

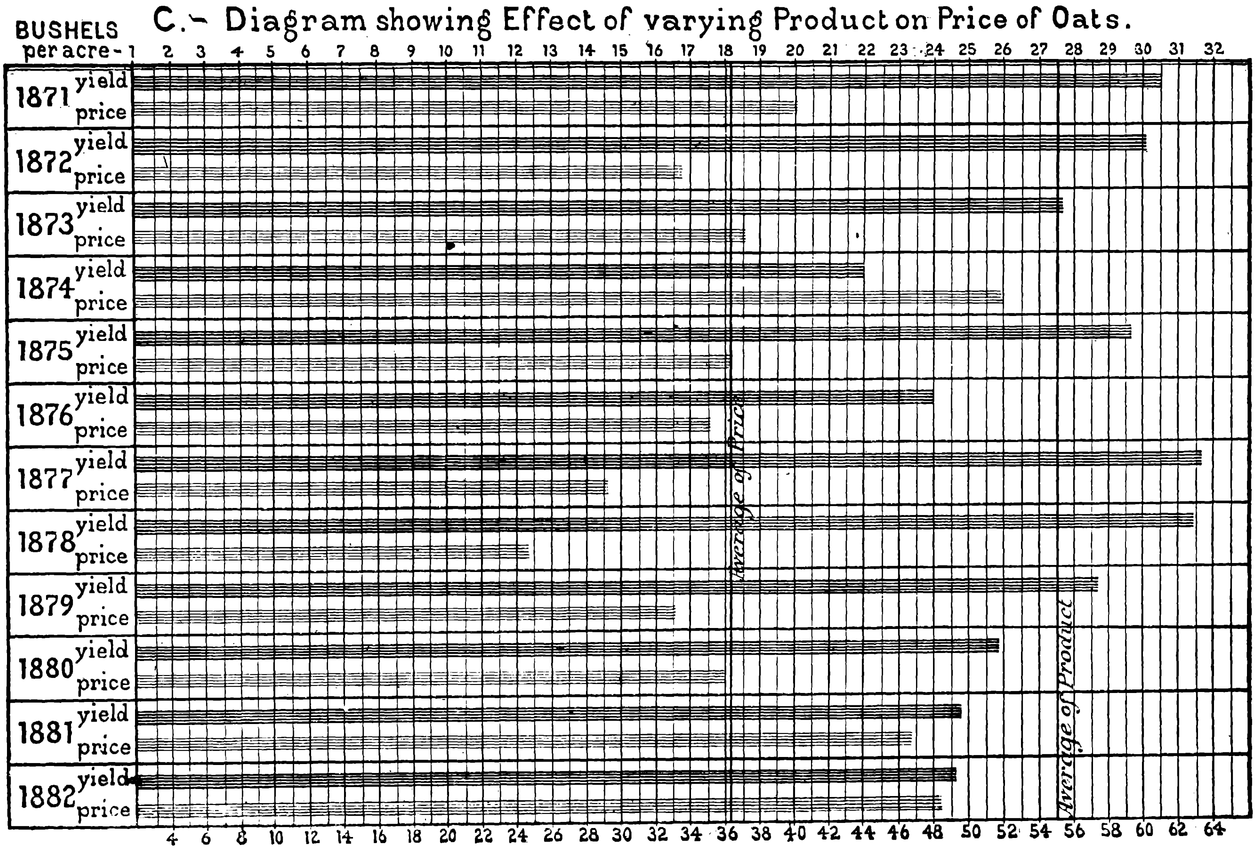
Compare this district with the remainder of the country, where there is a small surplus sometimes produced in two or three States, a bare supply in a few others, while most of them require some assistance from the corn belt, the result is shown as follows:

Years.	Seven States.		Thirty-one States and Territories.	
	Bushels.	*Per cent.*	*Bushels.*	*Per cent.*
1849	214, 561, 378	36. 2	377, 509, 726	63. 8
1859	383, 242, 536	45. 7	455, 550, 206	54. 3
1869	405, 248, 452	53. 3	355, 696, 097	46. 7
1879	1, 201, 841, 335	68. 5	553, 020, 200	31. 5
1882	955, 595, 800	59. 1	661, 429, 300	40. 9

The price of corn in 1882 is an irrefragable proof of an under-medium crop. The reduction of five per cent. in quantity, with a quality also below medium, is quite consistent with an average price of 48.4 cents per bushel against 43.1 cents, the average of eleven previous years. Studying the effect of varying product upon price, we find that two large crops in 1871 and 1872 brought down the average price from 48.2 to 39.8 cents in a single year. In 1873 there was an under-average crop of 23.8 bushels per acre, and the price advanced to 48 cents again. In 1874 a second and worse reduction occurred to 20.7 bushels (with one exception the lowest record made), which caused a panic and forced the average rate to 64.7 cents per bushel. Then followed a series of fruitful years which may be considered remarkable even in the United States, from 1875 to 1880, in which every crop was full to large, furnishing a surplus that only low prices and much waste could dispose of; and in this period there was a gradation towards extreme cheapness, from 64.7 to 42, 37, 35.8, and 31.8 cents per bushel. The lowest point made was after five successive crops, and then came a small advance, in 1880, the full crop of that year notwithstanding, from the impetus given to feeding beeves for the English market, and the rise of prices

B.—Diagram showing Effect of varying Product on Price of Corn.




C.– Diagram showing Effect of varying Product on Price of Oats.
BUSHELS per acre
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32
1871 yield price
1872 yield price
1873 yield price
1874 yield price
1875 yield price
1876 yield price
1877 yield price
1878 yield price
1879 yield price
1880 yield price
1881 yield price
1882 yield price
Average of Price
Average of Product
4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58 60 62 64

from that cause, the losses of cattle on the plains in the hard winter of 1880, and the general tendency to advance in all prices.

The diagram (B) will show clearly the inter-relations of yield and price, and should be studied with care. The reader will remember that the basis of production here is rate of yield per acre, without reference to changing breadth in cultivation, which is in turn affected by price. Still the yield per acre indicates approximately the relative supply of each year.

Wheat was a favored crop in 1882. The yield was 13.6, which is 1.6 bushels above an average, and may be deemed a normal or full yield, represented by 100 in reports of condition of the growing crop. It represents a full crop in view of present conditions of wheat-growing throughout the entire field. It is only half what it should be if all wheat were the product of advanced methods of culture.

The winter wheat of 1882, seeded in the previous autumn, had a promising start, with seasonable rains for early growth, and with few exceptions an absence of the Hessian fly. In the spring less injury from alternate freezing and thawing occurred than for many years. The spring was from two to four weeks earlier than in 1881, the root growth greater, tillering unusually noticeable, with good color and marked vigor of growth. Jointing was in progress in the Gulf States in April. Condition continued high throughout the entire breadth until harvest. Spring wheat also enjoyed a favorable season and made a good yield.

OATS made a better yield than in any previous year since 1879, the average being 36.4 bushels per acre. In sympathy with corn, the price was a little higher than an average, 37.5 cents per bushel on the farm.

Attention is called to Diagram C for the purpose of showing the disturbing influence of the corn supply on the price of oats. Both grains are used for horse feed, and the proportions used depend on the relative prices. Corn was abundant at declining values in 1871 and 1872, and oats in the latter year were cheaper, though the quantity produced was diminished very slightly. In 1873 and in 1874 the crops of both grains were short, and prices consequently advanced. The corn crops from 1875 to 1880 were all above the average rate of yield, reducing sharply the price till 1879, carrying the value of oats lower than the comparative supply would in itself have warranted. In 1881 a striking example of the inter-relation of uses and prices of corn and oats is afforded. Corn was a very short crop, and price advanced 60 per cent. Oats made a yield nearly the same as the previous year, yet the price went up 30 per cent., almost entirely through the rise in corn.

BARLEY averaged 21.5 bushels per acre, valued at 62.8 cents per bushel. The country never produces a supply of this grain, which is grown only in the North, and mostly in a half-dozen States. The proximity of Rochester and Milwaukee to Canada induces a large trade in Canadian barley.

BUCKWHEAT was less productive last year than usual, producing 13.1 bushels per acre.

POTATOES were not an average crop. The average for eleven years was 84.2 bushels per acre. In 1882, 78.7 bushels. The crop started well, and indicated a large product early in July. In New England and New York a subsequent drought, prolonged and severe, cut down production heavily. Results were generally favorable in other sections of the country.

CROP ESTIMATES FOR 1882.

Table showing the product of the crops named, by States and Territories, the yield per acre, the total acreage, the average price in each State, and the value of each crop for 1882.

Products.	Quantity produced in 1882.	Average yield per acre.	Number of acres in each crop.	Value per bushel, pound, or ton.	Total valuation.
MAINE.					
Indian corn ... bushels	904,400	29.2	30,987	$0 92	$832,048
Wheat ... do	512,100	11.7	43,700	1 40	716,940
Rye ... do	29,250	11.8	2,470	1 10	32,175
Oats ... do	1,776,700	21.4	82,921	55	977,185
Barley ... do	195,200	18.1	10,767	85	165,920
Buckwheat ... do	432,600	20.2	21,412	60	259,560
Potatoes ... do	6,684,496	100.0	66,845	75	4,013,372
Tobacco ... pounds	...	...	...	...	...
Hay ... tons	1,054,614	.97	1,083,958	12 70	13,393,598
Total	...	...	1,343,060	...	20,390,798
NEW HAMPSHIRE.					
Indian corn ... bushels	870,700	23.4	37,269	96	835,872
Wheat ... do	148,700	12.9	11,500	1 35	200,745
Rye ... do	28,900	8.9	3,264	92	26,588
Oats ... do	1,030,000	34.3	29,997	55	566,500
Barley ... do	68,000	18.7	3,636	87	59,160
Buckwheat ... do	78,200	16.8	4,646	75	58,650
Potatoes ... do	2,380,505	78.0	30,519	70	1,666,353
Tobacco ... pounds	155,296	1412.0	110	12	18,636
Hay ... tons	622,135	1.01	615,851	12 75	7,932,221
Total	...	...	736,792	...	11,364,725
VERMONT.					
Indian corn ... bushels	1,930,300	33.9	56,916	94	1,814,482
Wheat ... do	378,000	17.9	21,150	1 27	480,060
Rye ... do	102,960	16.1	6,386	90	92,664
Oats ... do	3,445,300	34.3	100,495	50	1,722,650
Barley ... do	287,850	25.6	11,256	86	247,551
Buckwheat ... do	337,590	19.7	17,170	65	219,433
Potatoes ... do	4,118,179	100.1	41,159	68	2,800,362
Tobacco ... pounds	126,099	1417.0	89	13	16,393
Hay ... tons	1,009,556	1.06	955,238	11 73	11,842,092
Total	...	...	1,209,859	...	19,235,687
MASSACHUSETTS.					
Indian corn ... bushels	1,237,200	21.7	57,120	95	1,175,340
Wheat ... do	20,100	17.0	1,180	1 45	29,145
Rye ... do	440,020	16.4	26,772	93	409,219
Oats ... do	703,000	30.7	22,869	59	414,770
Barley ... do	70,520	21.9	3,216	90	63,468
Buckwheat ... do	69,350	12.6	5,500	90	62,415
Potatoes ... do	2,939,053	87.4	33,646	85	2,498,195
Tobacco ... pounds	4,250,819	1435.0	2,962	12½	531,352
Hay ... tons	681,221	1.11	611,259	18 00	12,261,978
Total	...	...	764,524	...	17,445,882
RHODE ISLAND.					
Indian corn ... bushels	277,900	23.0	12,100	92	255,668
Wheat ... do	520	...	...	1 40	728
Rye ... do	15,680	11.3	1,386	92	14,426
Oats ... do	155,800	27.5	5,656	58	90,364
Barley ... do	17,575	22.0	800	85	14,939
Buckwheat ... do	1,309	10.4	126	85	1,113
Potatoes ... do	544,320	85.7	6,350	80	435,456
Tobacco ... pounds	...	...	...	...	...
Hay ... tons	76,963	1.10	69,657	17 50	~~134,685~~
Total	...	...	96,075	...	~~247,379~~

2,159,547

1,346,853

Table showing the product of the crops, &c., for 1882—Continued.

Products.	Quantity produced in 1882.	Average yield per acre.	Number of acres in each crop.	Value per bushel, pound, or ton.	Total valuation.
CONNECTICUT.					
Indian corn ....bushels..	1,155,800	20.1	57,577	$0 96	$1,109,568
Wheat ....do....	43,600	20.3	2,150	1 20	52,320
Rye ....do....	464,530	15.2	30,608	92	427,368
Oats ....do....	1,048,300	28.3	37,067	52	545,116
Barley ....do....	12,054	19.3	626	90	10,849
Buckwheat ....do....	137,240	12.4	11,088	80	109,792
Potatoes ....do....	2,479,145	76.6	32,372	82	2,032,899
Tobacco ....pounds..	9,772,269	1128.0	8,665	13	1,270,396
Hay ....tons..	551,946	.96	574,707	17 35	9,576,263
Total	....	....	754,860	....	15,134,571
NEW YORK.					
Indian corn ....bushels....	21,187,500	27.5	769,115	77	16,314,375
Wheat ....do....	12,145,200	15.7	772,400	1 10	13,359,720
Rye ....do....	2,876,400	12.0	239,292	76	2,186,064
Oats ....do....	40,068,000	29.9	1,337,947	45	18,030,600
Barley ....do....	8,916,720	24.8	359,459	80	7,133,376
Buckwheat ....do....	3,471,520	12.2	285,192	75	2,603,640
Potatoes ....do....	30,618,749	80.2	381,674	61	18,677,437
Tobacco ....pounds..	9,751,386	1210.0	8,059	12	1,170,166
Hay ....tons....	5,777,721	1.16	4,962,158	12 25	70,777,082
Total	....	....	9,115,296	....	150,252,460
NEW JERSEY.					
Indian corn ....bushels..	9,942,800	28.9	343,536	76	7,556,528
Wheat ....do....	2,098,700	13.6	154,000	1 12	2,350,544
Rye ....do....	1,060,800	10.7	99,498	72	763,776
Oats ....do....	3,808,800	29.2	130,482	47	1,790,136
Barley ....do....	4,116	16.3	252	82	3,375
Buckwheat ....do....	349,440	10.3	34,006	85	297,024
Potatoes ....do....	2,977,190	72.9	40,816	65	1,935,173
Tobacco ....pounds..	194,407	1130.0	172	11	21,385
Hay ....tons..	513,489	1.0	514,100	17 25	8,857,685
Total	....	....	1,316,862	....	23,575,626
PENNSYLVANIA.					
Indian corn ....bushels..	43,518,800	31.3	1,388,245	70	30,463,160
Wheat ....do....	20,300,700	13.6	1,488,700	1 05	21,315,735
Rye ....do....	4,009,500	10.2	394,332	74	2,967,030
Oats ....do....	34,721,100	27.3	1,273,335	45	15,624,495
Barley ....do....	628,800	22.7	27,694	80	503,040
Buckwheat ....do....	3,575,700	14.5	246,440	73	2,610,261
Potatoes ....do....	15,860,880	80.7	196,425	57	9,040,702
Tobacco ....pounds..	31,044,529	1043.0	29,772	12	3,725,343
Hay ....tons..	3,187,291	1.18	2,711,457	12 00	38,247,492
Total	....	....	7,756,400	....	124,497,258
DELAWARE.					
Indian corn ....bushels..	3,936,600	18.9	208,182	59	2,322,594
Wheat ....do....	1,200,600	12.2	98,800	1 07	1,284,642
Rye ....do....	7,020	8.6	816	65	4,563
Oats ....do....	410,800	19.5	21,033	45	184,860
Barley ....do....	....	....	....	....	....
Buckwheat ....do....	6,325	15.5	408	60	3,795
Potatoes ....do....	293,935	72.4	4,061	70	205,754
Tobacco ....pounds..	....	....	....	....	....
Hay ....tons..	49,627	1.02	48,655	14 25	707,185
Total	....	....	381,955	....	4,713,393
MARYLAND.					
Indian corn ....bushels..	17,904,700	25.9	691,542	58	10,384,726
Wheat ....do....	8,655,600	14.0	620,000	1 07	9,261,492
Rye ....do....	327,750	12.0	27,352	66	216,315
Oats ....do....	1,658,900	16.7	99,330	44	729,916
Barley ....do....	6,324	26.1	242	80	5,059
Buckwheat ....do....	147,250	14.8	9,975	70	103,075
Potatoes ....do....	1,574,244	76.3	20,619	68	1,070,486
Tobacco ....pounds....	29,232,216	749.0	39.030	6	1,753,933
Hay ....tons....	286,022	1.1	283,520	13,50	3,861,297
Total	....	....	1,791,610	....	27,386,299

Table showing the product of the crops, &c., for 1882—Continued.

Products.	Quantity produced in 1882.	Average yield per acre	Number of acres in each crop.	Value per bushel, pound, or ton.	Total valuation.
VIRGINIA.					
Indian corn.........bushels..	35, 904, 000	19. 1	1, 881, 568	$0 53	$19, 029, 120
Wheat.........do....	8, 311, 400	9. 0	918. 900	1 06	8, 810, 084
Rye.........do....	334, 400	6. 7	50, 085	75	250, 800
Oats.........do....	5, 457, 060	8. 8	622, 212	47	2, 564, 818
Barley.........do....	19, 175	16. 2	1, 187	80	15, 340
Buckwheat.........do....	198, 900	12. 1	16, 432	66	131, 274
Potatoes.........do....	2, 197, 696	63. 3	34, 718	61	1, 340, 595
Tobacco.........pounds..	89, 297, 332	621. 0	143, 853	7. 3	6, 518, 705
Hay.........tons..	310, 580	1. 10	281, 838	12. 55	3, 897, 779
Total.........	....	....	3, 950, 793	....	42, 558, 515
NORTH CAROLINA.					
Indian corn.........bushels..	34, 260, 700	14. 0	2, 446, 056	53	18, 158, 171
Wheat.........do....	5, 494, 800	7. 7	710, 000	1 06	5, 824, 488
Rye.........do....	402, 320	6. 3	63, 630	86	345, 995
Oats.........do....	5, 713, 400	9. 8	582, 245	48	2, 742, 432
Barley.........do....	2, 625	10. 2	257	80	2, 100
Buckwheat.........do....	59, 800	10. 5	5, 670	60	35, 880
Potatoes.........do....	1, 100, 370	55. 6	19, 803	75	825, 277
Tobacco.........pounds..	32, 275, 792	500. 0	64, 482	12	3, 873, 095
Hay.........tons..	97, 263	1. 19	81, 414	11 18	1, 087, 400
Total.........	....	....	3, 973, 557	....	32, 894, 838
SOUTH CAROLINA.					
Indian corn.........bushels..	16, 356, 200	12. 0	1, 361, 256	68	11, 122, 216
Wheat.........do....	1, 729, 000	7. 5	230, 000	1 20	2, 074, 800
Rye.........do....	34, 560	4. 7	7, 313	1 15	39, 744
Oats.........do....	4, 430, 100	12. 1	366, 470	50	2, 215, 050
Barley.........do....	17, 355	14. 3	1, 212	1 05	18, 223
Buckwheat.........do....	....	....	....	....	....
Potatoes.........do....	187, 074	53. 3	3, 512	85	159, 013
Tobacco.........pounds..	50, 380	249. 0	202	13	6, 549
Hay.........tons..	3, 344	1. 12	2, 990	11 50	38, 456
Total.........	....	....	1, 972, 955	....	15, 674, 051
GEORGIA.					
Indian corn.........bushels..	36, 617, 500	13. 3	2, 747, 005	65	23, 801, 375
Wheat.........do....	3, 812, 900	7. 5	510, 000	1 08	4, 117, 932
Rye.........do....	158, 400	5. 8	27, 375	1 00	158, 400
Oats.........do....	7, 325, 800	9. 5	765, 375	55	3, 979, 690
Barley.........do....	25, 300	15. 3	1, 650	1 00	25, 300
Buckwheat.........do....	....	....	....	....	....
Potatoes.........do....	397, 231	45.	8, 827	65	258, 200
Tobacco.........pounds..	262, 179	254.	1, 034	14	36, 705
Hay.........tons..	18, 155	1. 20	15, 129	10 50	190, 627
Total.........	....	....	4, 076, 395	....	32, 568, 229
FLORIDA.					
Indian corn.........bushels..	3, 708, 900	9. 5	392, 073	80	2, 967, 120
Wheat.........do....	350	4. 4	80	1 25	437
Rye.........do....	3, 424	5.	682	1 32	4, 520
Oats.........do....	509, 600	9. 7	52, 580	75	382, 200
Barley.........do....	....	....	....	....	....
Buckwheat.........do....	....	....	....	....	....
Potatoes.........do....	70, 848	44. 9	1, 579	95	67, 306
Tobacco.........pounds..	24, 239	151.	160	18	4, 363
Hay.........tons..	218	1. 03	211	14 70	3, 205
Total.........	....	....	447, 365	....	3, 429, 151
ALABAMA.					
Indian corn.........bushels..	31, 982, 500	13. 9	2, 300, 341	60	19, 189, 500
Wheat.........do....	1, 700, 800	6.	285, 000	1 12	1, 904, 896
Rye.........do....	32, 860	5. 5	5, 940	1 10	36, 146
Oats.........do....	4, 302, 200	10. 4	414, 756	60	2, 581, 320
Barley.........do....	6, 358	10. 1	630	1 10	6, 994
Buckwheat.........do....	....	....	....	....	....
Potatoes.........do....	410, 888	51. 7	7, 949	90	369, 799
Tobacco.........pounds..	475, 456	219.	2, 173	15	71, 318
Hay.........tons..	12, 513	1. 15	10, 882	12 00	150, 156
Total.........	....	....	3, 027, 671	....	24, 310, 129

Table showing the product of the crops, &c., for 1882—Continued.

Products.	Quantity produced in 1882.	Average yield per acre.	Number of acres in each crop.	Value per bushel, pound, or ton.	Total valuation.
MISSISSIPPI.					
Indian corn .... bushels..	30, 233, 600	16. 8	1, 798, 944	$0 55	$16, 628, 480
Wheat .... do....	250, 100	4. 5	55, 000	1 23	307, 623
Rye .... do....	5, 512	6. 2	884	90	4, 961
Oats .... do....	3, 080, 800	11. 5	268, 859	57	1, 756, 056
Barley .... do....	....	....	....	....	....
Buckwheat .... do....	....	....	....	....	....
Potatoes .... do....	363, 950	46. 5	7, 831	85	309, 357
Tobacco .... pounds..	462, 171	290.	1, 595	13	60, 082
Hay .... tons..	10, 886	1. 13	9, 625	14 50	157, 847
Total	....	....	2, 142, 738	....	19, 224, 406
LOUISIANA.					
Indian corn .... bushels..	14, 636, 400	18. 5	790, 336	60	8, 781, 840
Wheat .... do....	7, 500	3. 4	2, 200	1 25	9, 375
Rye .... do....	9, 600	8.	1, 200	90	8, 640
Oats .... do....	527, 800	16. 3	32, 472	60	316, 680
Barley .... do....	....	....	....	....	....
Buckwheat .... do....	....	....	....	....	....
Potatoes .... do....	263, 944	44. 9	5, 877	90	237, 550
Tobacco .... pounds..	....	....	....	....	....
Hay .... tons..	40, 445	1. 10	36, 777	15 70	635, 143
Total	....	....	868, 862	....	9, 989, 228
TEXAS.					
Indian corn .... bushels..	63, 416, 300	19. 3	3, 280, 329	58	36, 781, 454
Wheat .... do....	4, 173, 700	9. 1	460, 000	98	4, 090, 226
Rye .... do....	60, 900	12. 7	4, 800	92	56, 028
Oats .... do....	9, 988, 800	25. 7	388, 875	54	5, 393, 952
Barley .... do....	118, 720	18. 8	6, 325	80	94, 976
Buckwheat .... do....	....	....	....	....	....
Potatoes .... do....	485, 520	60. 9	7, 976	95	461, 244
Tobacco .... pounds..	241, 924	307.	788	14	33, 869
Hay .... tons..	81, 489	1. 15	70, 652	10 75	876, 007
Total	....	....	4, 219, 745	....	47, 787, 756
ARKANSAS.					
Indian corn .... bushels..	34, 485, 900	21. 6	1, 596, 672	46	15, 863, 514
Wheat .... do....	1, 566, 100	7. 3	215, 000	99	1, 550, 439
Rye .... do....	29, 700	6. 9	4, 290	99	29, 403
Oats .... do....	3, 131, 500	14. 3	219, 570	51	1, 597, 065
Barley .... do....	....	....	....	....	....
Buckwheat .... do....	....	....	....	....	....
Potatoes .... do....	660, 726	61. 7	10, 712	79	521, 974
Tobacco .... pounds..	1, 175, 906	554.	2, 124	08. 5	99, 952
Hay .... tons..	28, 988	1. 17	24, 751	13 00	376, 844
Total	....	....	2, 073, 119	....	20, 039, 191
TENNESSEE.					
Indian corn .... bushels..	75, 188, 600	24. 1	3, 119, 371	42	31, 579, 212
Wheat .... do....	9, 971, 200	7. 9	1, 260, 000	91	9, 073, 792
Rye .... do....	200, 200	5. 7	35, 425	79	158, 158
Oats .... do....	6, 860, 520	11. 8	580, 683	41	2, 812, 813
Barley .... do....	42, 120	14. 2	2, 964	68	28, 642
Buckwheat .... do....	44, 290	8. 4	5, 304	68	30, 117
Potatoes .... do....	1, 924, 337	55. 5	34, 699	55	1, 058, 385
Tobacco .... pounds..	31, 020, 220	740.	41, 897	06. 7	2, 078, 355
Hay .... tons..	217, 316	1. 20	181, 097	12 83	2, 788, 164
Total	....	....	5, 261, 440	....	49, 607, 638
WEST VIRGINIA.					
Indian corn .... bushels..	14, 927, 000	25. 4	588, 233	58	8, 657, 660
Wheat .... do....	4, 854, 300	11. 3	430, 000	95	4, 611, 585
Rye .... do....	166, 650	9. 7	17, 238	70	116, 655
Oats .... do....	1, 888, 200	14. 7	128, 544	45	849, 690
Barley .... do....	10, 762	21. 1	510	69	7, 426
Buckwheat .... do....	390, 000	12. 1	32, 130	70	273, 000
Potatoes .... do....	1, 487, 808	59. 4	25, 033	50	743, 904
Tobacco .... pounds..	2, 169, 858	512.	4, 235	10	216, 986
Hay .... tons..	260, 683	1. 14	228, 042	9 50	2, 476, 488
Total	....	....	1, 453, 965	....	17, 953, 394

Table showing the product of the crops, &c., for 1882—Continued.

Products.	Quantity produced in 1882.	Average yield per acre.	Number of acres in each crop.	Value per bushel, pound, or ton.	Total valuation.
KENTUCKY.					
Indian corn .... bushels..	75, 500, 900	24. 3	3, 103, 248	$0 52	$39, 260, 468
Wheat .... do....	17, 250, 000	13. 4	1, 287, 000	90	15, 525, 000
Rye .... do....	881, 380	9. 8	90, 335	69	608, 152
Oats .... do....	7, 187, 400	17. 1	420, 525	40	2, 874, 960
Barley .... do....	464, 400	22. 3	20, 806	69	320, 436
Buckwheat .... do....	11, 130	9. 6	1, 155	71	7, 902
Potatoes .... do ...	2, 820, 933	53. 6	52, 668	47	1, 325, 839
Tobacco .... pounds..	198, 905, 994	821.	242, 227	08	15, 912, 480
Hay .... tons..	254, 065	1. 23	206, 198	10 00	2, 540, 650
Total	....	....	5, 424, 162	....	78, 375, 887
OHIO.					
Indian corn .... bushels..	93, 319, 200	31. 3	2, 977, 680	62	57, 857, 904
Wheat .... do....	43, 453, 600	15. 1	2, 876, 000	95	41, 280, 920
Rye .... do....	352, 800	12. 4	28, 405	65	229, 320
Oats .... do....	18, 400, 000	26. 4	697, 000	46	8, 464, 000
Barley .... do....	1, 144, 440	16. 8	68, 095	75	858, 330
Buckwheat .... do....	190, 320	8. 5	22, 338	79	150, 353
Potatoes .... do....	10, 283, 810	66. 2	155, 313	60	6, 170, 286
Tobacco .... pounds..	33, 648, 917	995.	33, 819	07	2, 355, 424
Hay .... tons..	2, 751, 272	1. 22	2, 255, 141	9 60	26, 412, 211
Total	....	....	9, 113, 791	....	143, 778, 748
MICHIGAN.					
Indian corn .... bushels..	28, 581, 600	30. 7	929, 760	59	16, 863, 144
Wheat .... do....	32, 315, 400	16. 3	1, 985, 000	90	29, 083, 860
Rye .... do....	273, 710	12. 5	21, 917	65	177, 911
Oats .... do....	18, 237, 570	31. 7	574, 704	37	6, 747, 901
Barley .... do....	1, 348, 920	24. 9	54, 075	75	1, 011, 690
Buckwheat .... do....	510, 120	15. 4	33, 166	67	341, 780
Potatoes .... do....	12, 364, 102	89. 5	138, 168	43	5, 316, 564
Tobacco .... pounds..	92, 091	509.	181	13	11, 972
Hay .... tons..	1, 456, 613	1. 17	1, 243, 591	11 75	17, 115, 203
Total	....	....	4, 980, 562	....	76, 670, 025
INDIANA.					
Indian corn .... bushels..	107, 484, 300	31. 3	3, 438, 332	48	51, 592, 464
Wheat .... do....	45, 461, 800	16. 5	2, 763, 000	90	40, 915, 620
Rye .... do....	263, 940	10. 8	24, 522	67	176, 840
Oats .... do....	18, 853, 200	26. 8	703, 490	35	6, 598, 620
Barley .... do....	415, 800	25. 5	16, 280	75	311, 850
Buckwheat .... do....	88, 480	11. 2	7, 920	77	68, 130
Potatoes .... do....	7, 227, 060	80. 6	89, 704	50	3, 613, 530
Tobacco .... pounds..	9, 108, 860	806.	11, 298	07	637, 620
Hay .... tons..	1, 649, 633	1. 31	1, 260, 136	9 00	14, 846, 697
Total	....	....	8, 314, 682	....	118, 761, 371
ILLINOIS.					
Indian corn .... bushels..	182, 336, 900	23.	7, 914, 042	47	85, 698, 343
Wheat .... do...	52, 302, 900	17. 7	2, 956, 000	86	44, 980, 494
Rye .... do....	6, 538, 000	18. 3	357, 000	56	3, 661, 280
Oats .... do....	99, 141, 000	40. 7	2, 434, 662	32	31, 725, 120
Barley .... do....	942, 500	19. 7	47, 824	66	622, 050
Buckwheat .... do....	158, 360	8. 5	18, 525	73	115, 603
Potatoes .... do....	11, 696, 558	84. 6	138, 304	50	5, 848, 279
Tobacco .... pounds..	3, 848, 124	745.	5, 163	08	307, 850
Hay .... tons..	3, 439, 743	1. 25	2, 744, 870	8 80	30, 269, 738
Total	....	....	16, 616, 390	....	203, 228, 757
WISCONSIN.					
Indian corn .... bushels..	32, 201, 600	28. 8	1, 117, 240	53	17, 066, 848
Wheat .... do....	23, 145, 400	14. 4	1, 610, 000	90	20, 830, 860
Rye .... do....	2, 470, 650	14. 3	172, 725	58	1, 432, 977
Oats .... do....	34, 324, 400	29. 6	1, 157, 732	32	10, 983, 808
Barley .... do....	5, 772, 640	25	230, 906	55	3, 174, 952
Buckwheat .... do....	378, 280	11. 4	33, 166	75	283, 710
Potatoes .... do....	7, 943, 760	74. 3	106, 880	40	3, 177, 504
Tobacco .... pounds..	10, 443, 324	928.	11, 250	12	1, 253, 199
Hay .... tons..	1, 896, 769	1. 16	1, 633, 034	6 00	11, 380, 614
Total	....	....	6, 072, 933	....	69, 584, 472

Table showing the product of the crops, &c., for 1882—Continued.

Products.	Quantity produced in 1882.	Average yield per acre.	Number of acres in each crop.	Value per bushel, pound, or ton.	Total valuation.
MINNESOTA.					
Indian corn........bushels..	21,127,600	32	661,050	$0 45	$9,507,420
Wheat........do....	33,030,500	13	2,547,000	82	27,085,010
Rye........do....	395,650	15.1	26,200	53	209,694
Oats........do....	29,950,000	35.7	840,000	30	8,985,000
Barley........do....	7,204,000	23.3	309,000	47	3,385,880
Buckwheat........do....	50,600	9.1	5,550	63	31,878
Potatoes........do....	5,132,018	92.3	55,610	37	1,898,847
Tobacco........pounds..	....	....	....	....	....
Hay........tons..	1,746,585	1.29	1,359,053	5 75	10,042,864
Total........	....	....	5,803,463	....	61,146,593
IOWA.					
Indian corn........bushels..	175,487,600	25.9	6,777,302	38	66,685,288
Wheat........do....	25,487,200	10.3	2,485,000	70	17,841,040
Rye........do....	1,540,080	12.8	120,120	50	770,040
Oats........do....	52,618,160	31	1,699,635	28	14,783,085
Barley........do....	4,647,400	22.6	201,360	48	2,182,752
Buckwheat........do....	180,360	10.8	16,680	72	129,859
Potatoes........do....	10,792,897	84	128,444	38	4,101,301
Tobacco........pounds..	....	....	....	....	....
Hay........tons..	3,860,412	1.22	3,173,330	5 25	20,267,163
Total........	....	....	14,601,871	....	126,710,528
MISSOURI.					
Indian corn........bushels..	170,037,000	29.5	5,763,102	39	66,314,430
Wheat........do....	27,538,600	11.8	2,335,000	85	23,407,810
Rye........do....	696,160	13.8	50,570	53	368,965
Oats........do....	30,073,500	30.1	997,568	32	9,623,520
Barley........do....	181,800	22.7	8,000	65	118,170
Buckwheat........do....	69,300	12.2	5,671	65	45,045
Potatoes........do....	5,192,618	71.8	72,376	44	2,284,752
Tobacco........pounds..	15,547,770	930	16,182	8	1,203,822
Hay........tons..	1,194,685	1.12	1,066,683	7 60	9,079,606
Total........	....	....	10,315,152	....	112,446,120
KANSAS.					
Indian corn........bushels..	144,452,600	33.7	4,280,430	37	53,447,462
Wheat........do....	31,248,000	19.9	1,573,000	67	20,936,160
Rye........do....	4,450,000	22.5	198,000	40	1,780,000
Oats........do....	12,780,800	27	472,619	30	3,834,240
Barley........do....	267,300	12.8	20,882	53	141,669
Buckwheat........do....	25,200	8.6	2,940	80	20,160
Potatoes........do....	3,993,931	62.8	63,615	55	2,196,662
Tobacco........pounds..	....	....	....	....	....
Hay........tons..	1,636,261	1.19	1,370,765	4 00	6,545,044
Total........	....	....	7,982,251	....	88,901,397
NEBRASKA.					
Indian corn........bushels..	82,478,200	34.9	2,364,120	33	27,217,806
Wheat........do....	18,300,000	11	1,657,000	67	12,261,000
Rye........do....	932,800	17.4	53,480	40	373,120
Oats........do....	9,417,600	23.5	400,119	25	2,354,400
Barley........do....	3,588,000	23	156,000	42	1,506,960
Buckwheat........do....	17,340	7.9	2,205	80	13,872
Potatoes........do....	3,143,146	84	37,418	33	1,037,238
Tobacco........pounds..	....	....	....	....	....
Hay........tons..	841,199	1.24	680,970	3 25	2,733,897
Total........	....	....	5,351,312	....	47,498,293
CALIFORNIA.					
Indian corn........bushels..	2,790,900	28.3	98,634	85	2,372,265
Wheat........do....	36,046,600	13	2,767,000	90	32,441,940
Rye........do....	187,131	8.8	21,295	85	159,061
Oats........do....	1,548,000	24	64,416	58	897,840
Barley........do....	9,131,400	16.4	558,480	67	6,118,038
Buckwheat........do....	25,300	22	1,150	80	20,240
Potatoes........do....	4,434,453	82.5	53,751	60	2,660,672
Tobacco........pounds..	....	....	....	....	....
Hay........tons..	1,121,558	1.39	806,818	13 00	14,580,254
Total........	....	....	4,371,544	....	59,250,310

Table showing the product of the crops, &c., for 1882—Continued.

Products.	Quantity produced in 1882.	Average yield per acre.	Number of acres in each crop.	Value per bushel, pound, or ton.	Total valuation.
OREGON.					
Indian corn .... bushels..	130,000	23.9	5,450	$0 80	$104,000
Wheat .... do....	12,039,300	16.7	723,000	85	10,233,405
Rye .... do....	17,296	17.1	1,009	87	15,048
Oats .... do....	4,433,500	28.5	155,448	52	2,305,420
Barley .... do....	819,500	27.4	29,870	60	491,700
Buckwheat .... do....	7,762	15.7	495	82	6,365
Potatoes .... do....	1,251,284	110.6	11,312	57	713,232
Tobacco .... pounds..					
Hay .... tons..	263,366	1.39	190,057	13 25	3,489,599
Total			1,116,641		17,358,769
NEVADA.					
Indian corn .... bushels..	18,000	21.7	830	90	16,200
Wheat .... do....	95,000	21	4,520	1 20	114,000
Rye .... do....					
Oats .... do....	221,000	30.7	7,200	75	165,750
Barley .... do....	468,000	22.1	21,210	90	421,200
Buckwheat .... do....					
Potatoes .... do....	390,000	91.8	4,250	98	382,200
Tobacco .... pounds..					
Hay .... tons..	100,704	1.33	75,945	12 50	1,258,800
Total			113,955		2,358,150
COLORADO.					
Indian corn .... bushels..	422,400	20	21,076	90	380,160
Wheat .... do....	1,598,200	16.8	95,000	94	1,502,308
Rye .... do....	28,224	17.7	1,592	90	25,405
Oats .... do....	780,000	28.4	27,500	65	507,000
Barley .... do....	92,400	19	4,851	92	85,008
Buckwheat .... do....					
Potatoes .... do....	437,000	76.3	5,730	72	314,640
Tobacco .... pounds..					
Hay .... tons..	90,209	1.24	73,026	13 75	1,240,374
Total			228,775		4,054,895
ARIZONA.					
Indian corn .... bushels....	57,000	21	2,709	1 10	62,700
Wheat .... do....	220,000	14.2	15,500	1 40	308,000
Rye .... do....					
Oats .... do....					
Barley .... do....	327,500	18.9	17,366	95	311,125
Buckwheat .... do....					
Potatoes .... do....	72,750	75	970	1 10	80,025
Tobacco .... pounds..					
Hay .... tons..	12,500	1.04	12,000	18 50	231,250
Total			48,515		993,100
DAKOTA.					
Indian corn .... bushels..	4,650,000	25	186,247	51	2,371,500
Wheat .... do....	11,460,000	15.9	720,000	80	9,168,000
Rye .... do....	79,167	13.8	5,724	75	59,375
Oats .... do....	3,600,000	25.7	140,000	38	1,368,000
Barley .... do....	471,621	16.7	28,273	55	259,392
Buckwheat .... do....	3,908	8.1	481	70	2,736
Potatoes .... do....	1,118,500	106.5	10,500	38	425,030
Tobacco .... pounds..					
Hay .... tons..	440,000	1.16	380,000	4 25	1,870,000
Total			1,471,225		15,524,033
IDAHO.					
Indian corn .... bushels..	45,000	28.5	1,580	1 05	47,250
Wheat .... do....	650,000	16	40,625	1 40	910,000
Rye .... do....	10,635	13.7	779	80	8,508
Oats .... do....	760,000	36.2	21,000	75	570,000
Barley .... do....	329,700	29.5	11,193	90	296,730
Buckwheat .... do....					
Potatoes .... do....	250,000	104.2	2,400	1 00	250,000
Tobacco .... pounds..					
Hay .... tons..	57,000	1.19	48,000	11 50	655,500
Total			125,577		2,737,988

Table showing the product of the crops, &c., for 1882—Continued.

Products.	Quantity produced in 1882.	Average yield per acre.	Number of acres in each crop.	Value per bushel, pound, or ton.	Total valuation.
MONTANA.					
Indian corn....bushels..	18,000	36.6	492	$1 05	$18,900
Wheat....do....	685,000	16	42,812	1 45	993,250
Rye....do....	....	....	....	....	....
Oats....do....	1,100,000	39.3	28,000	75	825,000
Barley....do....	53,959	29.1	1,852	1 00	53,959
Buckwheat....do....	581	13.2	44	80	465
Potatoes....do....	300,000	120	2,500	1 00	300,000
Tobacco....pounds..	....	....	....	....	....
Hay....tons..	93,000	1.07	87,000	10 00	930,000
Total....	....	....	162,700	....	3,121,574
NEW MEXICO.					
Indian corn....bushels..	965,000	21.2	45,594	1 10	1,061,500
Wheat....do....	767,000	12	63,917	1 50	1,150,500
Rye....do....	....	....	....	....	....
Oats....do....	185,000	16.5	11,200	90	166,500
Barley....do....	53,557	19.1	2,803	1 00	53,557
Buckwheat....do....	....	....	....	....	....
Potatoes....do....	40,500	90	450	1 25	50,625
Tobacco....pounds..	....	....	....	....	....
Hay....tons..	13,000	1.18	11,000	18 00	234,000
Total....	....	....	134,964	....	2,716,682
UTAH.					
Indian corn....bushels..	275,000	20.8	13,208	90	247,500
Wheat....do....	1,250,000	15.3	81,500	92	1,150,000
Rye....do....	21,131	10.5	2,018	80	16,905
Oats....do....	520,000	22.3	23,350	61	317,200
Barley....do....	227,997	19.1	11,944	85	193,797
Buckwheat....do....	....	....	....	....	....
Potatoes....do....	805,500	90	8,950	49	394,695
Tobacco....pounds..	....	....	....	....	....
Hay....tons..	135,000	1.12	120,000	9 00	1,215,000
Total....	....	....	260,970	....	3,535,097
WASHINGTON.					
Indian corn....bushels..	62,000	23.4	2,646	80	49,600
Wheat....do....	2,440,000	16.5	148,000	83	2,025,200
Rye....do....	19,947	17.1	1,165	85	16,955
Oats....do....	2,120,000	40.	53,000	49	1,038,800
Barley....do....	651,518	35.5	18,350	68	443,032
Buckwheat....do....	2,798	22.	127	62	1,735
Potatoes....do....	1,175,100	140.4	8,370	80	940,080
Tobacco....pounds..	....	....	....	....	....
Hay....tons..	175,000	1.14	153,000	14 50	2,537,500
Total....	....	....	384,658	....	7,052,902
WYOMING.					
Indian corn....bushels..	....	....	....	....	....
Wheat....do..	25,000	16.	1,560	1 20	30,000
Rye....do..	....	....	....	....	....
Oats....do..	47,000	26.9	1,750	50	23,500
Barley....do..	....	....	....	....	....
Buckwheat....do..	....	....	....	....	....
Potatoes....do..	85,500	90.	950	1 10	94,050
Tobacco....pounds..	....	....	....	....	....
Hay....tons..	17,000	1.13	15.000	12 50	212,500
Total....	....	....	19,260	....	360,050

Summary for each State, showing the product, the area, and the value of each crop for 1882.

States and Territories.	Corn.			Wheat.		
	Bushels.	Acres.	Value.	Bushels.	Acres.	Value.
Maine	904, 400	30, 987	$832, 048	512, 100	43, 700	$716, 940
New Hampshire	870, 700	37, 269	835, 872	148, 700	11, 500	200, 745
Vermont	1, 930, 300	56, 916	1, 814, 482	378, 000	21, 150	480, 060
Massachusetts	1, 237, 200	57, 120	1, 175, 340	20, 100	1, 180	29, 145
Rhode Island	277, 900	12, 100	255, 668	[illegible]	....	728
Connecticut	1, 155, 800	57, 577	1, 109, 568	43, 600	2, 150	52, 320
New York	21, 187, 500	769, 115	16, 314, 375	12, 145, 200	772, 400	13, 359, 720
New Jersey	9, 942, 800	343, 536	7, 556, 528	2, 098, 700	154, 000	2, 350, 544
Pennsylvania	43, 518, 800	1, 388, 245	30, 463, 160	20, 300, 700	1, 488, 700	21, 315, 735
Delaware	3, 936, 600	208, 182	2, 322, 594	1, 200, 600	98, 800	1, 284, 642
Maryland	17, 904, 700	691, 542	10, 384, 726	8, 655, 600	620, 000	9, 261, 492
Virginia	35, 904, 000	1, 881, 568	19, 029, 120	8, 311, 400	918, 900	8, 810, 084
North Carolina	34, 260, 700	2, 446, 056	18, 158, 171	5, 494, 800	710, 000	5, 824, 488
South Carolina	16, 356, 200	1, 361, 256	11, 122, 216	1, 729, 000	230, 000	2, 074, 800
Georgia	36, 617, 500	2, 747, 005	23, 801, 375	3, 812, 900	510, 000	4, 117, 932
Florida	3, 708, 900	392, 073	2, 967, 120	350	80	437
Alabama	31, 982, 500	2, 300, 341	19, 188, 500	1, 700, 800	285, 000	1, 904, 896
Mississippi	30, 233, 600	1, 798, 944	16, 628, 480	250, 100	55, 000	307, 623
Louisiana	14, 636, 400	790, 336	8, 781, 840	7, 500	2, 200	9, 375
Texas	63, 416, 300	3, 280, 329	36, 781, 454	4, 173, 700	460, 000	4, 090, 226
Arkansas	34, 485, 900	1, 596, 672	15, 863, 514	1, 566, 100	215, 000	1, 550, 439
Tennessee	75, 188, 600	3, 119, 371	31, 579, 212	9, 971, 200	1, 260, 000	9, 073, 792
West Virginia	14, 927, 000	588, 233	8, 657, 660	4, 854, 300	430, 000	4, 611, 585
Kentucky	75, 500, 900	3, 103, 248	39, 260, 468	17, 250, 000	1, 287, 000	15, 525, 000
Ohio	93, 319, 200	2, 977, 680	57, 857, 904	43, 453, 600	2, 876, 000	41, 280, 920
Michigan	28, 581, 600	929, 760	16, 863, 144	32, 315, 400	1, 985, 000	29, 083, 860
Indiana	107, 484, 300	3, 438, 332	51, 592, 464	45, 461, 800	2, 763, 000	40, 915, 620
Illinois	182, 336, 900	7, 914, 042	85, 698, 343	52, 302, 900	2, 956, 000	44, 980, 494
Wisconsin	32, 201, 600	1, 117, 240	17, 066, 848	23, 145, 400	1, 610, 000	20, 830, 860
Minnesota	21, 127, 600	661, 050	9, 507, 420	33, 030, 500	2, 547, 000	27, 085, 010
Iowa	175, 487, 600	6, 777, 302	66, 685, 288	25, 487, 200	2, 485, 000	17, 841, 040
Missouri	170, 037, 000	5, 763, 102	66, 614, 430	27, 538, 600	2, 335, 000	23, 407, 810
Kansas	144, 452, 600	4, 280, 430	53, 447, 462	31, 248, 000	1, 573, 000	20, 936, 160
Nebraska	82, 478, 200	2, 364, 120	27, 217, 806	18, 300, 000	1, 657, 000	12, 261, 000
California	2, 790, 900	98, 634	2, 372, 265	36, 046, 600	2, 767, 000	32, 441, 940
Oregon	130, 000	5, 450	104, 000	12, 039, 300	723, 000	10, 233, 405
Nevada	18, 000	830	16, 200	95, 000	4, 520	114, 000
Colorado	422, 400	21, 076	380, 160	1, 598, 200	95, 000	1, 502, 308
Arizona	57, 000	2, 709	62, 700	220, 000	15, 500	308, 000
Dakota	4, 650, 000	186, 247	2, 371, 500	11, 460, 000	720, 000	9, 168, 000
Idaho	45, 000	1, 580	47, 250	650, 000	40, 625	910, 000
Montana	18, 000	492	18, 900	685, 000	42, 812	993, 250
New Mexico	965, 000	45, 594	1, 061, 500	767, 000	63, 917	1, 150, 500
Utah	275, 000	13, 208	247, 500	1, 250, 000	81, 500	1, 150, 000
Washington	62, 000	2, 646	49, 600	2, 440, 000	148, 000	2, 025, 200
Wyoming	....	....	....	25, 000	1, 560	30, 000
Indian Territory	....	....	....	....	....	....
Total	1, 617, 025, 100	65, 659, 546	783, 867, 175	504, 185, 470	37, 067, 194	444, 602, 125

States and Territories.	Oats.			Rye.		
	Bushels.	Acres.	Value.	Bushels.	Acres.	Value.
Maine	1, 776, 700	82, 921	$977, 185	29, 250	2, 470	$32, 175
New Hampshire	1, 030, 000	29, 997	566, 500	28, 900	3, 264	26, 588
Vermont	3, 445, 300	100, 495	1, 722, 650	102, 960	6, 386	92, 664
Massachusetts	703, 000	22, 869	414, 770	440, 020	26, 772	409, 219
Rhode Island	155, 800	5, 656	90, 364	15, 680	1, 386	14, 426
Connecticut	1, 048, 300	37, 067	545, 116	464, 530	30, 608	427, 368
New York	40, 068, 000	1, 337, 947	18, 030, 600	2, 876, 400	239, 292	2, 186, 064
New Jersey	3, 808, 800	130, 482	1, 790, 136	1, 060, 800	99, 498	763, 776
Pennsylvania	34, 721, 100	1, 273, 335	15, 624, 495	4, 009, 500	394, 332	2, 967, 030
Delaware	410, 800	21, 033	184, 860	7, 020	816	4, 563
Maryland	1, 658, 900	99, 330	729, 916	327, 750	27, 352	216, 315
Virginia	5, 457, 060	622, 212	2, 564, 818	334, 400	50, 085	250, 800
North Carolina	5, 713, 400	582, 245	2, 742, 432	402, 320	63, 630	345, 995
South Carolina	4, 430, 100	366, 470	2, 215, 050	34, 560	7, 313	39, 744
Georgia	7, 235, 800	765, 375	3, 979, 690	158, 400	27, 375	158, 400
Florida	509, 600	52, 580	382, 200	3, 424	682	4, 520
Alabama	4, 302, 200	414, 756	2, 581, 320	32, 860	5, 940	36, 146
Mississippi	3, 080, 800	268, 859	1, 756, 056	5, 512	884	4, 961
Louisiana	527, 800	32, 472	316, 680	9, 600	1, 200	8, 640
Texas	9, 988, 800	388, 875	5, 353, 952	60, 900	4, 800	56, 028

Summary for each State, showing the product, the area, and the value, &c.—Continued.

States and Territories.	Oats.			Rye.		
	Bushels.	Acres.	Value.	Bushels.	Acres.	Value.
Arkansas	3, 131, 500	219, 570	$1, 597, 065	29, 700	4, 290	$29, 403
Tennessee	6, 860, 520	580, 683	2, 812, 813	290, 200	35, 425	158, 158
West Virginia	1, 888, 200	128, 544	849, 690	166, 650	17, 238	116, 655
Kentucky	7, 187, 400	420, 525	2, 874, 960	881, 380	90, 335	608, 152
Ohio	18, 400, 000	697, 000	8, 464, 000	352, 800	28, 405	229, 320
Michigan	18, 237, 570	574, 704	6, 747, 901	273, 710	21, 917	177, 911
Indiana	18, 853, 200	703, 490	6, 598, 620	263, 940	24, 522	176, 840
Illinois	99, 141, 000	2, 434, 662	31, 725, 120	6, 538, 000	357, 000	3, 661, 280
Wisconsin	34, 324, 400	1, 157, 732	10, 983, 808	2, 470, 650	172, 725	1, 432, 977
Minnesota	29, 950, 000	840, 000	8, 985, 000	395, 650	26, 200	209, 694
Iowa	52, 618, 160	1, 699, 635	14, 733, 085	1, 540, 080	120, 120	770, 040
Missouri	30, 073, 500	997, 568	9, 623, 520	696, 160	50, 570	368, 965
Kansas	12, 780, 800	472, 619	3, 834, 240	4, 450, 000	198, 000	1, 780, 000
Nebraska	9, 417, 600	400, 119	2, 354, 400	932, 800	53, 480	373, 120
California	1, 548, 000	64, 416	897, 840	187, 131	21, 295	159, 061
Oregon	4, 433, 500	155, 448	2, 305, 420	17, 296	1, 009	15, 048
Nevada	221, 000	7, 200	165, 750			
Colorado	780, 000	27, 500	507, 000	28, 224	1, 592	25, 405
Arizona						
Dakota	3, 600, 000	140, 000	1, 368, 000	79, 167	5, 724	59, 375
Idaho	760, 000	21, 000	570, 000	10, 635	779	8, 508
Montana	1, 100, 000	28, 000	825, 000			
New Mexico	185, 000	11, 200	166, 500			
Utah	520, 000	23, 350	317, 200	21, 131	2, 018	16, 905
Washington	2, 120, 000	53, 000	1, 038, 800	19, 947	1, 165	16, 955
Wyoming	47, 000	1, 750	23, 500			
Total	488, 250, 610	18, 494, 691	182, 978, 022	29, 960, 037	2, 227, 889	18, 439, 194

States and Territories.	Barley.			Buckwheat.		
	Bushels.	Acres.	Value.	Bushels.	Acres.	Value.
Maine	195, 200	10, 767	$165, 920	432, 600	21, 412	$259, 560
New Hampshire	68, 000	3, 636	59, 160	78, 200	4, 646	58, 650
Vermont	287, 850	11, 256	247, 551	337, 590	17, 170	219, 433
Massachusetts	70, 520	3, 216	63, 468	69, 350	5, 500	62, 415
Rhode Island	17, 575	800	14, 939	1, 309	126	1, 113
Connecticut	12, 054	626	10, 849	137, 240	11, 088	109, 792
New York	8, 916, 720	359, 459	7, 133, 376	3, 471, 520	285, 192	2, 603, 640
New Jersey	4, 116	252	3, 375	349, 440	34, 006	297, 024
Pennsylvania	628, 800	27, 694	503, 040	3, 575, 700	246, 440	2, 610, 261
Delaware				6, 325	408	3, 795
Maryland	6, 324	242	5, 059	147, 250	9, 975	103, 075
Virginia	19, 175	1, 187	15, 340	198, 900	16, 432	131, 274
North Carolina	2, 625	257	2, 100	59, 800	5, 670	35, 880
South Carolina	17, 355	1, 212	18, 223			
Georgia	25, 300	1, 650	25, 300			
Florida						
Alabama	6, 358	630	6, 994			
Mississippi						
Louisiana						
Texas	118, 720	6, 325	94, 976			
Arkansas						
Tennessee	42, 120	2, 964	28, 642	44, 290	5, 304	30, 117
West Virginia	10, 762	510	7, 426	390, 000	32, 130	273, 000
Kentucky	464, 400	20, 806	320, 436	11, 130	1, 155	7, 902
Ohio	1, 144, 440	68, 095	858, 330	190, 320	22, 338	150, 353
Michigan	1, 348, 920	54, 075	1, 011, 690	510, 120	33, 166	341, 780
Indiana	415, 800	16, 280	311, 850	88, 480	7, 920	68, 130
Illinois	942, 500	47, 824	622, 050	158, 360	18, 525	115, 603
Wisconsin	5, 772, 640	230, 906	3, 174, 952	378, 280	33, 166	283, 710
Minnesota	7, 204, 000	309, 000	3, 385, 880	50, 600	5, 550	31, 878
Iowa	4, 547, 400	201, 360	2, 182, 752	180, 360	16, 680	129, 859
Missouri	181, 800	8, 000	118, 170	69, 300	5, 671	45, 045
Kansas	267, 300	20, 882	141, 669	25, 200	2, 940	20, 160
Nebraska	3, 588, 000	156, 000	1, 506, 960	17, 340	2, 205	13, 872
California	9, 131, 400	558, 480	6, 118, 038	25, 300	1, 150	20, 240
Oregon	819, 500	29, 870	491, 700	7, 762	495	6, 365
Nevada	468, 000	21, 210	421, 200			
Colorado	92, 400	4, 851	85, 008			
Arizona	327, 500	17, 366	311, 125			
Dakota	471, 621	28, 273	259, 392	3, 908	481	2, 736
Idaho	329, 700	11, 193	296, 730			

Summary for each State, showing the product, the area, and the value, &c.—Continued.

States and Territories.	Barley.			Buckwheat.		
	Bushels.	Acres.	Value.	Bushels.	Acres.	Value.
Montana	53, 959	1, 852	$53, 959	581	44	$465
New Mexico	53, 557	2, 803	53, 557			
Utah	227, 997	11, 994	193, 797			
Washington	651, 518	18, 350	443, 032	2, 798	127*	1, 735
Wyoming						
Total	48, 953, 926	2, 272, 103	30, 768, 015	11, 019, 353	847, 112	8, 038, 862

States and Territories.	Potatoes.			Hay.		
	Bushels.	Acres.	Value.	Tons.	Acres.	Value.
Maine	6, 684, 496	66, 845	$5, 013, 372	1, 054, 614	1, 083, 958	$13, 393, 598
New Hampshire	2, 380, 505	30, 519	1, 666, 353	622, 135	615, 851	7, 932, 221
Vermont	4, 118, 179	41, 159	2, 800, 362	1, 009, 556	955, 238	11, 842, 092
Massachusetts	2, 939, 053	33, 646	2, 498, 195	681, 221	611, 259	12, 261, 978
Rhode Island	544, 320	6, 350	435, 456	76, 963	69, 657	~~134, 685~~ 1346
Connecticut	2, 479, 145	32, 372	2, 032, 899	551, 946	574, 707	9, 576, 263
New York	30, 618, 749	381, 674	18, 677, 437	5, 777, 721	4, 962, 158	70, 777, 082
New Jersey	2, 977, 190	40, 816	1, 935, 173	513, 489	514, 100	8, 857, 685
Pennsylvania	15, 860, 880	196, 425	9, 040, 702	3, 187, 291	2, 711, 457	38, 247, 492
Delaware	293, 935	4, 061	205, 754	49, 627	48, 655	707, 185
Maryland	1, 574, 244	20, 619	1, 070, 486	286, 022	283, 520	3, 861, 297
Virginia	2, 197, 696	34, 718	1, 340, 595	310, 580	281, 838	3, 897, 779
North Carolina	1, 100, 370	19, 803	825, 277	97, 263	81, 414	1, 087, 400
South Carolina	187, 074	3, 512	159, 013	3, 344	2, 990	38, 456
Georgia	397, 231	8, 827	258, 200	18, 155	15, 129	190, 627
Florida	70, 848	1, 579	67, 306	218	211	3, 205
Alabama	410, 888	7, 949	369, 799	12, 513	10, 882	150, 156
Mississippi	363, 950	7, 831	309, 357	10, 886	9, 625	157, 847
Louisiana	263, 944	5, 877	237, 550	40, 455	36, 777	635, 143
Texas	485, 520	7, 976	461, 244	81, 489	70, 652	876, 007
Arkansas	660, 726	10, 712	521, 974	28, 988	24, 751	376, 844
Tennessee	1, 924, 337	34, 699	1, 058, 385	217, 316	181, 097	2, 788, 164
West Virginia	1, 487, 808	25, 033	743, 904	260, 683	228, 042	2, 476, 488
Kentucky	2, 820, 933	52, 668	1, 325, 839	254, 065	206, 198	2, 540, 650
Ohio	10, 283, 810	155, 313	6, 170, 286	2, 751, 272	2, 255, 141	26, 412, 211
Michigan	12, 364, 102	138, 168	5, 316, 564	1, 456, 613	1, 243, 591	17, 115, 203
Indiana	7, 227, 060	89, 704	3, 613, 530	1, 649, 633	1, 260, 136	14, 846, 697
Illinois	11, 696, 558	138, 304	5, 848, 279	3, 439, 743	2, 744, 870	30, 269, 738
Wisconsin	7, 943, 760	106, 880	3, 177, 504	1, 896, 769	1, 633, 034	11, 380, 614
Minnesota	5, 132, 018	55, 610	1, 898, 847	1, 746, 585	1, 359, 053	10, 042, 864
Iowa	10, 792, 897	128, 444	4, 101, 301	3, 860, 412	3, 173, 330	20, 267, 163
Missouri	5, 192, 618	72, 376	2, 284, 752	1, 194, 685	1, 066, 683	9, 079, 606
Kansas	3, 993, 931	63, 615	2, 196, 662	1, 636, 261	1, 370, 765	6, 545, 044
Nebraska	3, 143, 146	37, 418	1, 037, 238	841, 199	680, 970	2, 733, 897
California	4, 434, 453	53, 751	2, 660, 672	1, 121, 558	806, 818	14, 580, 254
Oregon	1, 251, 284	11, 312	713, 232	263, 366	190, 057	3, 489, 599
Nevada	390, 000	4, 250	382, 200	100, 704	75, 945	1, 258, 800
Colorado	437, 000	5, 730	314, 640	90, 209	73, 026	1, 240, 374
Arizona	72, 750	970	80, 025	12, 500	12, 000	231, 250
Dakota	1, 118, 500	10, 500	425, 030	440, 000	380, 000	1, 870, 000
Idaho	250, 000	2, 400	250, 000	57, 000	48, 000	655, 500
Montana	300, 000	2, 500	300, 000	93, 000	87, 000	930, 000
New Mexico	40, 500	450	50, 625	13, 000	11, 000	234, 000
Utah	805, 500	8, 950	394, 695	135, 000	120, 000	1, 215, 000
Washington	1, 175, 100	8, 370	940, 080	175, 000	153, 000	2, 537, 500
Wyoming	85, 500	950	94, 050	17, 000	15, 000	212, 500
Total	170, 972, 508	2, 171, 636	95, 304, 844	38, 138, 049	32, 339, 585	~~309, 958, 158~~

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Summary for each State, showing the product, the area, and the value, &c.—Continued.

States and Territories.	Tobacco.			Cotton.		
	Pounds.	Acres.	Value.	Bales.	Acres.	Value.
Maine	....	....	....	....	....	....
New Hampshire	155, 296	110	$18, 636	....	....	....
Vermont	126, 099	89	16, 393	....	....	....
Massachusetts	4, 250, 819	2, 962	531, 352	....	....	....
Rhode Island	....	....	....	....	....	....
Connecticut	9, 772, 269	8, 665	1, 270, 396	....	....	....
New York	9, 751, 386	8, 059	1, 170, 166	....	....	....
New Jersey	194, 407	172	21, 385	....	....	....
Pennsylvania	31, 044, 529	29, 772	3, 725, 343	....	....	....
Delaware	....	....	....	....	....	....
Maryland	29, 232, 216	39, 030	1, 753, 933	....	....	
Virginia	89, 297, 332	143, 853	6, 518, 705	24, 000	55, 786	$1, 032, 000
North Carolina	32, 275, 792	64, 482	3, 873, 095	463, 000	1, 050, 543	19, 909, 000
South Carolina	50, 380	202	6, 549	630, 000	1, 618, 989	27, 090, 000
Georgia	262, 179	1, 034	36, 705	942, 000	2, 872, 748	41, 448, 500
Florida	24, 239	160	4, 363	62, 000	257, 799	3, 472, 000
Alabama	475, 456	2, 173	71, 318	810, 000	2, 610, 420	36, 450, 000
Mississippi	462, 171	1, 595	60, 082	1, 064, 000	2, 278, 521	47, 348, 000
Louisiana	....	....	....	560, 000	931, 900	24, 920, 000
Texas	241, 924	788	33, 869	1, 326, 000	3, 034, 922	59, 670, 000
Arkansas	1, 175, 906	2, 124	99, 952	697, 000	1, 188, 545	31, 365, 000
Tennessee	31, 020, 220	41, 897	2, 078, 355	337, 000	807, 602	15, 165, 000
West Virginia	2, 169, 858	4, 235	216, 986	....	....	....
Kentucky	198, 905, 994	242, 227	15, 912, 480	....	....	....
Ohio	33, 648, 917	33, 819	2, 355, 424	....	....	....
Michigan	92, 091	181	11, 972	....	....	....
Indiana	9, 108, 860	11, 298	637, 620	....	....	....
Illinois	3, 848, 124	5, 163	307, 850	....	....	....
Wisconsin	10, 443, 324	11, 250	1, 253, 199	....	....	....
Minnesota	....	....	....	....	....	....
Iowa	....	....	....	....	....	....
Missouri, Indian Territory, and other States	15, 047, 770	16, 182	1, 203, 822	42, 000	83, 782	1, 827, 000
Total	513, 077, 558	671, 522	43, 189, 951	6, 957, 000	16, 791, 557	309, 696, 500

Table showing the average yield per acre and the price per bushel, pound, or ton, of farm products for the year 1882.

States and Territories.	Corn.		Wheat.		Oats.		Rye.		Barley.	
	Bushels.	Price per bushel.	Bushels.	Price per bushel.	Bushels.	Price per bushel.	Bushels.	Price per bushel.	Bushels.	Price per bushel.
Maine	29. 2	$0 92	11. 7	$1 40	21. 4	$0 55	11. 8	$1 10	18. 1	$0 85
New Hampshire	23. 4	96	12. 9	1 35	34. 3	55	8. 9	92	18. 7	87
Vermont	33. 9	94	17. 9	1 27	34. 3	50	16. 1	90	25. 6	86
Massachusetts	21. 7	95	17. 0	1 45	30. 7	59	16. 4	93	21. 9	90
Rhode Island	23. 0	92	....	1 40	27. 5	58	11. 3	92	22. 0	85
Connecticut	20. 1	96	20. 3	1 20	28. 3	52	15. 2	92	19. 3	90
New York	27. 5	77	15. 7	1 10	29. 9	45	12. 0	76	24. 8	80
New Jersey	28. 9	76	13. 6	1 12	29. 2	47	10. 7	72	16. 3	82
Pennsylvania	31. 3	70	13. 6	1 05	27. 3	45	10. 2	74	22. 7	80
Delaware	18. 9	59	12. 2	1 07	19. 5	45	8. 6	65	....	....
Maryland	25. 9	58	14. 0	1 07	16. 7	44	12. 0	66	26. 1	80
Virginia	19. 1	53	9. 0	1 06	8. 8	47	6. 7	75	16. 2	80
North Carolina	14. 0	53	7. 7	1 06	9. 8	48	6. 3	86	10. 2	80
South Carolina	12. 0	68	7. 5	1 20	12. 1	50	4. 7	1 15	14. 3	1 05
Georgia	13. 3	65	7. 5	1 08	9. 5	55	5. 8	1 00	15. 3	1 00
Florida	9. 5	80	4. 4	1 25	9. 7	75	5. 0	1 32	....	....
Alabama	13. 9	60	6. 0	1 12	10. 4	60	5. 5	1 10	10 1	1 10
Mississippi	16. 8	55	4. 5	1 23	11. 5	57	6. 2	90	....	....
Louisiana	18. 5	60	3. 4	1 25	16. 3	60	8. 0	90	....	....
Texas	19. 3	58	9. 1	98	25. 7	54	12. 7	92	18. 8	80
Arkansas	21. 6	46	7. 3	99	14. 3	51	6. 9	99	....	....
Tennessee	24. 1	42	7. 9	91	11. 8	41	5. 7	79	14. 2	68
West Virginia	25. 4	58	11. 3	95	14. 7	45	9. 7	70	21. 1	69
Kentucky	24. 3	52	13. 4	90	17. 1	40	9. 8	69	22. 3	69
Ohio	31. 3	62	15. 1	95	26. 4	46	12. 4	65	16. 8	75
Michigan	30. 7	59	16. 3	90	31. 7	37	12. 5	65	24. 9	75
Indiana	31. 3	48	16. 5	90	26. 8	35	10. 8	67	25. 5	75

Table showing the average yield per acre and the price per bushel, &c.—Continued.

States and Territories.	Corn.		Wheat.		Oats.		Rye.		Barley.	
	Bushels.	Price per bushel.	Bushels.	Price per bushel.	Bushels.	Price per bushel.	Bushels.	Price per bushel.	Bushels.	Price per bushel.
Illinois	23.0	$0 47	17.7	$0 86	40.7	$0 32	18.3	$0 56	19.7	$0 66
Wisconsin	28.8	53	14.4	90	29.6	32	14.3	58	25.0	55
Minnesota	32.0	45	13.0	82	35.7	30	15.1	53	23.3	47
Iowa	25.9	38	10.3	70	31.0	28	12.8	50	22.6	48
Missouri	29.5	39	11.8	85	30.1	32	13.8	53	22.7	65
Kansas	33.7	37	19.9	67	27.0	30	22.5	40	12.8	53
Nebraska	34.9	33	11.0	67	23.5	25	17.4	40	23.0	42
California	28.3	85	13.0	90	24.0	58	8.8	85	16.4	67
Oregon	23.9	80	16.7	85	28.5	52	17.1	87	27.4	60
Nevada	21.7	90	21.0	1 20	30.7	75	......	......	22.1	90
Colorado	20.0	90	16.8	94	28.4	65	17.7	90	19.0	92
Arizona	21.0	1 10	14.2	1 40	......	......	......	......	18.9	95
Dakota	25.0	51	15.9	80	25.7	38	13.8	75	16.7	55
Idaho	28.5	1 05	16.0	1 40	36.2	75	13.7	80	29.5	90
Montana	36.6	1 05	16.0	1 45	39.3	75	......	......	29.1	1 00
New Mexico	21.2	1 10	12.0	1 50	16.5	90	......	......	19.1	1 00
Utah	20.8	90	15.3	92	22.3	61	10.5	80	19.1	85
Washington	23.4	80	16.5	83	40.0	49	17.1	85	35.5	68
Wyoming	......	......	16.0	1 20	26.9	50	......	......	......	......

States and Territories.	Buckwheat.		Potatoes.		Hay.		Tobacco.		Cotton.	
	Bushels.	Price per bushel.	Bushels.	Price per bushel.	Tons.	Price per ton.	Pounds.	Price per pound.	Net pounds per acre.	Price per pound.
								Cts.		
Maine	20.2	$0 60	100.0	$0 75	.97	$12 70	......	......	......	......
New Hampshire	16.8	75	78.0	70	1.01	12 75	1,412	12.0	......	......
Vermont	19.7	65	100.1	68	1.06	11 73	1,417	13.0	......	......
Massachusetts	12.6	90	87.4	85	1.11	18 00	1,435	12.5	......	......
Rhode Island	10.4	85	85.7	80	1.10	17 50	......	......	......	......
Connecticut	12.4	80	76.6	82	.96	17 35	1,128	13.0	......	......
New York	12.2	75	80.2	61	1.16	12 25	1,210	12.0	......	......
New Jersey	10.3	85	72.9	65	1.00	17 25	1,130	11.0	......	......
Pennsylvania	14.5	73	80.7	57	1.18	12 00	1,043	12.0	......	......
Delaware	15.5	60	72.4	70	1.02	14 25	......	......	......	......
Maryland	14.8	70	76.3	68	1.01	13 50	749	6.0	......	......
Virginia	12.1	66	63.3	61	1.10	12 55	621	7.3	189	$0 09.8
North Carolina	10.5	60	55.6	75	1.19	11 18	500	12.0	194	9.8
South Carolina	......	......	53.3	85	1.12	11 50	249	13.0	171	9.8
Georgia	......	......	45.0	65	1.20	10 50	254	14.0	146	9.9
Florida	......	......	44.9	95	1.03	14 70	151	18.0	96	14.0
Alabama	......	......	51.7	90	1.15	12 00	219	15.0	141	9.9
Mississippi	......	......	46.5	85	1.13	14 50	290	13.0	210	9.9
Louisiana	......	......	44.9	90	1.10	15 70	......	......	270	9.9
Texas	......	......	60.9	95	1.15	10 75	307	14.0	201	9.8
Arkansas	......	......	61.7	79	1.17	13 00	554	8.5	264	10.0
Tennessee	8.4	68	55.5	55	1.20	12 83	740	6.7	188	10.0
West Virginia	12.1	70	59.4	50	1.14	9 50	512	10.0	......	......
Kentucky	9.6	71	53.6	47	1.23	10 00	821	8.0	......	......
Ohio	8.5	79	66.2	60	1.22	9 60	995	7.0	......	......
Michigan	15.4	67	89.5	43	1.17	11 75	509	13.0	......	......
Indiana	11.2	77	80.6	50	1.31	9 00	806	7.0	......	......
Illinois	8.5	73	84.6	50	1.25	8 80	745	8.0	......	......
Wisconsin	11.4	75	74.3	40	1.16	6 00	928	12.0	......	......
Minnesota	9.1	63	92.3	37	1.29	5 75	......	......	......	......
Iowa	10.8	72	84.0	38	1.22	5 25	......	......	......	......
Missouri	12.2	65	71.8	44	1.12	7 60	930	8.0	221	9.8
Kansas	8.6	80	62.8	55	1.19	4 00	......	......	......	......
Nebraska	7.9	80	84.0	33	1.24	3 25	......	......	......	......
California	22.0	80	82.5	60	1.39	13 00	......	......	......	......
Oregon	15.7	82	110.6	57	1.39	13 25	......	......	......	......
Nevada	......	......	91.8	98	1.33	12 50	......	......	......	......
Colorado	......	......	76.3	72	1.24	13 75	......	......	......	......
Arizona	......	......	75.0	1 10	1.04	18 50	......	......	......	......
Dakota	8.1	70	106.5	38	1.16	4 25	......	......	......	......
Idaho	......	......	104.2	1 00	1.19	11 50	......	......	......	......
Montana	13.2	80	120.0	1 00	1.07	10 00	......	......	......	......
New Mexico	......	......	90.0	1 25	1.18	18 00	......	......	......	......
Utah	......	......	90.0	49	1.12	9 00	......	......	......	......
Washington	22.0	62	140.4	80	1.14	14 50	......	......	......	......
Wyoming	......	......	90.0	1 10	1.13	12 50	......	......	......	......

Table showing the average cash value per acre of farm products for the year 1882.

States and Territories.	Corn.	Wheat.	Rye.	Oats.	Barley.	Buck-wheat.	Potatoes.	Tobacco.	Hay.
Maine	$26 86	$16 38	$12 98	$11 77	$15 38	$12 12	$75 00	....	$12 32
New Hampshire	22 46	17 41	8 19	18 86	16 27	12 60	54 60	$169 44	12 88
Vermont	31 87	22 73	14 49	17 15	22 02	12 80	68 07	184 21	12 43
Massachusetts	20 61	24 65	15 25	18 11	19 71	11 34	74 29	179 37	19 98
Rhode Island	21 16	....	10 40	15 95	18 70	8 84	68 56	....	19 25
Connecticut	19 30	24 36	13 98	14 72	17 37	9 92	62 81	146 64	16 67
New York	21 17	17 27	9 12	13 45	19 84	9 15	48 92	145 20	14 21
New Jersey	21 96	15 23	7 70	13 72	13 37	8 75	47 38	124 30	17 25
Pennsylvania	21 91	14 28	7 55	12 28	18 16	10 58	46 00	125 16	14 16
Delaware	11 15	13 05	5 59	8 77	....	9 30	50 68	....	14 53
Maryland	15 02	14 98	7 92	7 35	20 88	10 36	51 88	44 94	13 63
Virginia	10 12	9 54	5 02	4 14	12 96	7 99	38 61	45 33	13 80
North Carolina	7 42	8 16	5 42	4 70	8 16	6 30	41 70	60 00	13 30
South Carolina	8 16	9 00	5 40	6 05	15 01	....	45 30	32 37	12 88
Georgia	8 64	8 10	5 80	5 22	15 30	....	29 25	35 56	12 60
Florida	7 60	5 50	6 60	7 27	....	....	42 65	27 18	15 14
Alabama	8 34	6 72	6 05	6 24	11 11	....	46 53	32 85	13 80
Mississippi	9 24	5 53	5 58	6 55	....	....	39 52	37 70	16 38
Louisiana	11 10	4 25	7 20	9 78	....	....	40 41	....	17 27
Texas	11 19	8 92	11 68	13 88	15 04	....	57 85	42 98	12 36
Arkansas	9 94	7 23	6 83	7 29	....	....	48 74	47 09	15 21
Tennessee	10 12	7 19	4 50	4 84	9 66	5 71	30 52	49 58	15 40
West Virginia	14 73	10 73	6 79	6 61	14 56	8 47	29 70	51 20	10 83
Kentucky	12 64	12 06	6 76	6 84	15 39	6 82	25 19	65 68	12 30
Ohio	19 41	14 34	8 06	12 14	12 60	6 71	39 72	69 65	11 71
Michigan	18 11	14 67	8 12	11 73	18 67	10 32	38 48	66 17	13 75
Indiana	15 02	14 85	7 24	9 38	19 12	8 62	40 30	56 42	11 79
Illinois	10 81	15 22	10 25	13 02	13 00	6 20	42 30	59 60	11 00
Wisconsin	15 26	12 96	8 29	9 47	13 75	8 55	29 72	111 36	6 96
Minnesota	14 40	10 66	8 00	10 71	10 95	5 73	34 15	....	7 42
Iowa	9 84	7 21	6 40	8 68	10 85	7 78	31 92	....	6 40
Missouri	11 50	10 03	7 31	9 63	14 75	7 93	31 59	74 40	8 51
Kansas	12 47	13 33	9 00	8 10	6 78	6 88	34 54	....	4 76
Nebraska	11 52	7 37	6 96	5 87	9 66	6 32	27 72	....	4 03
California	24 05	11 70	7 48	13 92	10 99	17 60	49 50	....	18 07
Oregon	19 12	14 19	14 88	14 82	16 44	12 87	63 04	....	18 42
Nevada	19 53	25 20	....	23 02	19 89	....	89 96	....	16 62
Colorado	18 00	15 79	15 93	18 46	17 48	....	54 94	....	17 05
Arizona	23 10	19 88	....	....	17 95	....	82 50	....	19 24
Dakota	12 75	12 72	10 35	9 77	9 18	5 67	40 47	....	4 93
Idaho	29 92	22 40	10 96	27 15	26 55	....	104 20	....	13 68
Montana	38 43	23 20	....	29 47	29 10	10 56	120 00	....	10 70
New Mexico	23 32	18 00	....	14 85	19 10	....	90 00	....	21 24
Utah	18 72	14 08	8 40	13 60	16 23	....	112 50	....	10 08
Washington	18 72	13 69	14 53	19 60	24 14	13 64	68 79	....	16 53
Wyoming	....	19 20	....	13 45		....	72 00	....	14 12
Indian Territory	....	....	....	....	....	....	....	....	....

Table showing the average cash value per acre of the cereals, potatoes, tobacco, and hay of the farm, taken together, for the year 1882.

States.	Average value per acre.	States.	Average value per acre.
Maine	$15 18	Ohio	$15 78
New Hampshire	15 42	Michigan	15 39
Vermont	15 90	Indiana	14 28
Massachusetts	22 82	Illinois	12 23
Rhode Island	9 86	Wisconsin	11 46
Connecticut	20 05	Minnesota	10 54
New York	16 48	Iowa	8 68
New Jersey	17 90	Missouri	10 90
Pennsylvania	16 05	Kansas	11 14
Delaware	12 34	Nebraska	8 88
Maryland	15 29	California	13 55
Virginia	10 77	Oregon	15 55
North Carolina	8 28	Nevada	20 69
South Carolina	7 94	Colorado	17 72
Georgia	7 99	Arizona	20 47
Florida	7 67	Dakota	10 55
Alabama	8 03	Idaho	21 80
Mississippi	8 97	Montana	19 19
Louisiana	11 50	New Mexico	20 13
Texas	11 32	Utah	13 55
Arkansas	9 67	Washington	18 34
Tennessee	9 43	Wyoming	18 69
West Virginia	12 35	Average for United States	12 22
Kentucky	14 45		

A general summary showing the estimated quantities, number of acres, and aggregate value of the crops of the farm in 1882.

Products.	Quantity produced.	Number of acres.	Value.
	Bushels.		
Indian corn .... bushels..	1, 617, 025, 100	65, 659, 546	$783, 867, 175
Wheat .... do.....	504, 185, 470	37, 067, 194	444, 602, 125
Rye .... do.....	29, 960, 037	2, 227, 889	18, 439, 194
Oats .... do.....	488, 250, 610	18, 494, 691	182, 978, 022
Barley .... do.....	48, 953, 926	2, 272, 103	30, 768, 015
Buckwheat .... do.....	11, 019, 353	847, 112	8, 038, 862
Potatoes .... do.....	170, 972, 508	2, 171, 636	95, 304, 844
Total	2, 870, 367, 004	128, 740, 171	1, 563, 998, 237
Tobacco .... pounds..	513, 077, 558	671, 522	43, 189, 951
Hay .... tons..	38, 138, 049	32, 339, 585	~~369, 958, 158~~ 371,170,383
Grand total	....	161, 751, 298	1, 977, 146, 346 1978,358,574

Table showing the average yield and cash value per acre, and price per bushel, pound, or ton, of farm products for the year 1882.

Products.	Average yield per acre.	Average price per bushel.	Average value per acre.	Products.	Average yield per acre.	Average price per bushel, pound, or ton.	Average value per acre.
Indian corn . bushels..	24. 6+	$0 48. 4+	$11 91	Buckwheat . bushels.	13. 1 +	$0 72. 9+	$9 48
Wheat .... do....	13. 6+	88. 2−	12 00	Potatoes .... do...	78. 7 +	55. 7+	43 84
Rye .... do....	13. 4+	61. 5+	8 24	Tobacco .... pounds.	764. 0 +	8. 4+	64 18
Oats .... do....	26. 4−	37. 5−	9 64	Hay .... tons	1. 18+	9 70. 0+	11 45
Barley .... do....	21. 5+	62. 8+	13 50	Cotton ...... pounds.	186 +	9. 9−	18 43

FARM ANIMALS.

NUMBERS AND VALUES.

The increase in number of population and advance in price of meat have had a stimulating effect upon the stock-growing industry. The mild weather of the winter of 1881–'82 was also very favorable to increase of numbers on the Western ranges and in the Southwest, by avoidance of losses which in some winters largely counterbalance the natural increase. Numbers of cattle remain nearly stationary east of the Mississippi. There has been in operation a strong tendency in the Northwest to reduce the area in wheat and extend the breadth of corn and pasturage. It is a healthy tendency, sustained by the fact of superior profit in production of beef and milk, and encouraged by the uncertainty of wheat-growing and reduction of rate of yield under the *régime* of continuous wheat-culture. There has been a great advance in Dakota, Wyoming, Montana, and New Mexico.

The increase in prices has been rapid in the Territories during 1882 and 1883. The isolation of the public lands has been invaded by new railroads in the Northern and in the Southern Territories. Fertile nooks, watered by springs and streams, capable of irrigation for the production of hay, have been brought to light and made the centers of new ranches. The plains and mountains of the great West have been traversed for locations suitable for ranch enterprises. The abundance of money seeking investment and the low rate of interest prevailing have had the effect to stimulate the hitherto profitable business of stock-growing and increase the competition for herds of cattle and advance prices. In other words, stock in ranches, as well as railroad stock, has been *watered*. To such extent has the rise in prices been carried that calves are brought from the States by thousands, yearlings and two-year-olds are purchased in the Gulf States and driven in large numbers through Arkansas and Indian Territory to the mountains. Strange as it may seem, these classes of stock are worth more in Colorado and

Wyoming than in any other part of the United States. In this statement quality must of course be considered, and comparison made between animals of the same grades. This anomaly grows out of the large profits in grass-fed beeves of the plains, in the margin of profit in producing four year-old beeves from yearling stockers. Though the price of the former must ever be lower at Pine Bluff than at Chicago, the value of common yearlings may be greater in Wyoming than in Illinois, and the ranchmen still make a profit.

The annual returns of cattle are made in January. These estimates are based upon the reports of January, 1883. The number and value in the aggregate are thus stated:

Table showing the estimated numbers of farm stock expressed as a percentage of the numbers of the previous years; also, average of actual prices in January, 1883.

States and Territories.	Horses.					Mules.				
	Total number of horses compared with that of January, 1882.	Average price per head under 1 year old.	Average price per head between 1 and 2 years old.	Average price per head between 2 and 3 years old.	Average price per head over 3 years old.	Total number of mules compared with that of January, 1882.	Average price per head under 1 year old.	Average price per head between 1 and 2 years old.	Average price per head between 2 and 3 years old.	Average price per head over 3 years old.
	Pr. ct.					*Pr. ct.*				
Maine	101	$27 42	$42 69	$63 88	$89 19	100	$17 50	$30 00	$42 50	$68 33
New Hampshire	102	28 88	45 11	66 11	90 00	100	30 00	50 00	70 00	100 00
Vermont	100.2	26 58	41 25	64 00	95 08	103	28 00	47 00	66 00	95 00
Massachusetts	100.5	38 93	65 00	87 80	121 43	101	35 00	60 00	80 00	110 00
Rhode Island	100.5	34 00	56 67	81 00	125 00	100	32 00	58 00	76 00	105 00
Connecticut	101	31 25	54 50	75 00	91 67	100	30 00	48 00	65 00	105 00
New York	101	35 00	57 34	83 66	113 30	100	35 38	50 38	72 62	121 21
New Jersey	101	38 80	62 15	88 97	114 27	100	35 75	57 50	101 87	131 92
Pennsylvania	102	38 17	61 68	87 28	113 91	101	41 76	68 61	77 30	122 57
Delaware	100	36 00	57 50	82 50	110 00	100.3	38 00	62 00	90 00	130 00
Maryland	101	35 17	55 36	79 64	103 93	101	37 14	57 86	91 50	129 17
Virginia	100.2	28 80	46 95	68 34	88 42	100.2	33 96	55 53	82 86	101 97
North Carolina	101	27 54	43 65	65 37	85 54	100	32 07	50 95	78 45	97 18
South Carolina	102	30 92	50 17	71 85	100 28	102	37 50	57 75	86 36	113 61
Georgia	101	29 23	47 14	68 81	96 54	100	35 23	56 25	81 58	110 79
Florida	103	25 83	43 33	67 08	102 08	103	24 37	38 12	75 91	112 73
Alabama	101	24 00	37 79	57 92	85 00	103	30 00	47 00	71 00	92 00
Mississippi	101	24 50	36 97	52 35	86 86	103	28 96	43 41	64 84	91 18
Louisiana	100.5	16 07	23 93	35 20	67 16	100	23 33	35 22	57 80	87 25
Texas	105	13 00	19 00	28 50	42 27	103	23 27	33 70	48 58	66 53
Arkansas	104	21 90	31 71	44 38	72 90	105	27 56	39 45	57 44	84 40
Tennessee	101	30 29	45 24	64 27	85 05	102	42 02	60 02	84 01	103 21
West Virginia	100.3	28 34	43 29	62 29	84 43	103	33 54	51 96	76 43	96 73
Kentucky	100.3	31 74	46 88	64 30	96 24	102	41 45	58 92	82 36	106 32
Ohio	100.4	35 51	57 55	81 22	108 52	110	38 24	57 32	80 47	108 68
Michigan	103	34 72	55 55	81 25	110 40	104	34 44	56 67	81 11	111 11
Indiana	101	32 03	50 65	71 24	103 62	100.5	37 40	57 08	79 90	104 56
Illinois	100.5	32 10	49 15	72 73	107 23	101	38 38	56 17	80 63	105 16
Wisconsin	104	32 84	54 66	79 86	108 24	103	35 94	57 36	86 00	121 38
Minnesota	107	34 48	50 80	75 36	107 18	104	39 58	60 87	88 64	122 61
Iowa	105	30 98	47 61	68 74	95 70	104	37 21	57 57	83 70	110 92
Missouri	102	26 56	38 39	53 24	72 67	101	34 50	51 02	72 28	95 24
Kansas	106	24 56	37 36	54 93	75 29	103	31 92	48 25	70 13	98 16
Nebraska	108	27 94	40 42	57 24	102 12	109	33 93	50 22	75 10	106 56
California	100.5	19 33	31 11	47 25	71 19	104	32 11	47 71	68 67	95 47
Oregon	107	30 00	49 00	63 00	80 00	101	26 67	41 67	65 00	91 67
Nevada	106	14 33	20 75	26 25	52 00	103	26 67	40 00	56 67	97 50
Colorado	106	20 05	39 89	58 75	76 71	108	27 50	43 37	63 52	96 68
Arizona	107	15 00	22 00	27 50	46 50	112	12 00	18 00	37 50	66 00
Dakota	120	31 33	50 00	73 33	102 31	110	32 88	48 57	75 71	115 00
Idaho	102	25 00	25 00	35 00	50 00	100	....	....	....	75 00
Montana	105	25 00	39 25	55 75	75 50	101	41 67	60 00	81 67	156 67
New Mexico	104	16 00	25 33	39 17	55 83	109	22 50	35 00	40 00	62 50
Utah	105	19 37	34 50	54 83	74 58	102	22 00	39 00	66 00	93 33
Washington	107	27 50	42 50	59 50	98 64	112	32 50	46 25	65 00	108 33
Wyoming	110	15 00	20 00	30 00	40 00	100	....	....	....	75 00
Indian	125	10 00	15 00	20 00	50 00	110	25 00	50 00	75 00	125 00

Table showing the estimated numbers of farm stock, &c.—Continued.

States and Territories.	Milch cows.		Oxen and other cattle.				
	Total number of milch cows compared with that of January, 1882.	Average price per head.	Total number of oxen and other cattle compared with that of January, 1882.	Average price per head under 1 year old.	Average price per head between 1 and 2 years old.	Average price per head between 2 and 3 years old.	Average price per head over 3 years old.
	Per ct.		*Per ct.*				
Maine	100.3	$32 08	99	$9 69	$16 50	$25 97	$47 85
New Hampshire	101	32 00	100	8 80	16 22	29 00	50 11
Vermont	102	30 33	100	8 33	15 25	26 71	49 68
Massachusetts	101	39 29	101	10 50	19 50	30 67	50 79
Rhode Island	102	36 00	99	12 33	20 33	34 33	44 00
Connecticut	102	34 71	99	10 17	17 17	27 08	45 00
New York	101	37 93	99	11 15	20 06	32 06	44 04
New Jersey	102	39 63	100	12 00	19 98	30 35	45 85
Pennsylvania	101	35 89	99	10 34	19 26	30 05	43 84
Delaware	99	32 50	100	10 00	16 00	25 00	35 00
Maryland	101	30 07	99	10 50	16 14	26 29	36 64
Virginia	100.3	22 11	98	9 11	12 62	21 83	27 93
North Carolina	103	17 18	95	4 05	7 12	10 87	14 96
South Carolina	101	18 89	94	4 60	6 84	10 19	14 11
Georgia	101	17 18	99	4 23	6 82	10 30	14 45
Florida	101	14 12	107	4 20	6 87	8 46	10 75
Alabama	101	15 46	100	3 99	6 38	9 14	13 85
Mississippi	103	16 60	97	4 01	6 09	9 31	14 23
Louisiana	102	19 97	90	4 95	6 81	10 47	15 79
Texas	110	22 64	104	7 43	11 27	15 03	20 54
Arkansas	103	21 51	92	4 86	8 65	12 54	18 38
Tennessee	102	22 50	99	6 44	11 22	17 10	24 32
West Virginia	100.5	28 91	100	11 23	19 06	29 13	39 29
Kentucky	103	30 25	99	10 25	17 52	27 37	39 28
Ohio	103	35 00	99	11 80	21 10	33 68	46 89
Michigan	103	34 87	101	10 37	19 09	31 13	46 24
Indiana	102	31 55	100	10 21	17 91	27 77	39 04
Illinois	101	33 01	99	10 73	18 21	27 89	39 20
Wisconsin	106	33 20	105	9 25	16 60	25 48	38 46
Minnesota	109	30 88	106	8 21	14 49	26 78	40 78
Iowa	112	30 85	108	10 07	17 34	26 96	37 65
Missouri	102	25 22	101	9 04	15 12	22 73	31 57
Kansas	109	30 80	110	11 36	18 34	26 84	36 45
Nebraska	122	32 18	121	11 82	18 68	28 03	37 10
California	100	36 17	96	11 87	19 16	28 65	41 20
Oregon	106	31 43	101	8 21	15 17	22 67	32 14
Nevada	107	36 00	102	9 25	14 00	19 25	26 40
Colorado	117	39 08	113	14 10	21 00	28 40	34 50
Arizona	108	23 50	118	6 50	10 00	21 50	28 00
Dakota	135	30 84	143	10 59	17 19	28 62	39 50
Idaho	110	36 00	95	7 50	15 00	25 00	35 00
Montana	104	37 00	108	13 50	20 00	27 00	38 00
New Mexico	117	29 33	120	9 33	15 00	22 83	27 83
Utah	105	28 17	102	10 51	16 42	25 58	37 00
Washington	104	31 36	102	9 72	15 63	24 27	37 55
Wyoming	105	25 00	125	12 00	16 00	25 00	40 00
Indian	85	25 00	100	8 00	14 00	20 00	25 00

Table showing the estimated numbers of farm stock, &c.—Continued.

States and Territories.	Sheep.				Hogs.		
	Total number of sheep compared with that of January, 1882.	Average price per head under 1 year old.	Average price per head over 1 year old.	How many head of sheep were killed by dogs in your county in 1882?	Total number of hogs compared with that of January, 1882.	Average price per head under 1 year old.	Average price per head over 1 year old.
	Per ct.			*No.*	*Per ct.*		
Maine	100	$2 62	$3 38	1,432	99	$9 25	$22 33
New Hampshire	99	2 66	3 44	701	101	11 05	23 37
Vermont	101	3 40	5 02	414	99	8 75	20 00
Massachusetts	101	3 29	4 07	409	102	11 75	22 40
Rhode Island	101	3 00	4 33	52	101	11 33	21 67
Connecticut	99	3 12	4 07	770	101	8 54	17 75
New York	100	3 31	4 33	3,943	101	8 35	17 35
New Jersey	99	3 85	4 65	655	100	9 75	18 31
Pennsylvania	101	3 10	3 89	5,386	94	6 87	15 04
Delaware	100	3 00	3.50	175	100	6 00	15 00
Maryland	100.5	3 10	3 93	950	98	5 46	12 54
Virginia	100	2 27	2 90	3,824	87	3 93	8 70
North Carolina	99	1 04	1 55	11,394	95	2 88	6 33
South Carolina	100	1 29	1 86	912	99	2 95	6 25
Georgia	99	1 30	1 71	9,890	99	2 84	6 18
Florida	114	1 03	2 00	627	122	1 48	3 58
Alabama	99	1 22	1 66	6,110	103	3 31	6 26
Mississippi	101	1 27	1 76	3,353	92	2 87	6 36
Louisiana	95	1 24	1 90	5,815	90	2 60	6 86
Texas	125	1 70	2 85	3,065	103	2 69	5 92
Arkansas	96	1 24	1 74	5,196	85	2 46	6 00
Tennessee	100	1 46	2 00	6,318	97	4 14	9 23
West Virginia	100.5	2 06	2 99	2,189	88	4 56	9 79
Kentucky	101	2 22	3 03	6,731	99	4 29	9 86
Ohio	102	2 33	3 42	14,709	96	6 30	13 68
Michigan	105	2 36	3 61	3,942	102	6 23	14 78
Indiana	101	2 21	3 14	13,706	95	5 75	12 51
Illinois	112	2 10	3 20	5,300	96	5 51	12 46
Wisconsin	101	1 99	2 86	4,168	104	8 44	12 83
Minnesota	101	2 13	3 10	1,364	109	5 31	12 44
Iowa	103	2 14	3 15	2,698	92	6 12	12 89
Missouri	102	1 53	2 28	10,788	95	3 90	9 44
Kansas	115	1 74	2 62	2,174	111	6 73	13 57
Nebraska	130	2 01	2 96	389	116	6 40	11 60
California	93	1 52	2 21	2,550	95	5 48	10 07
Oregon	103	1 80	2 33	550	105	2 78	7 28
Nevada	125	1 42	2 36	....	120	8 00	16 50
Colorado	103	1 56	2 44	....	110	9 33	18 33
Arizona	111	2 00	3 00	....	120	7 00	20 00
Dakota	142	2 00	3 36	75	137	6 93	13 19
Idaho	100	1 50	3 00	....	100	5 00	15 00
Montana	115	2 37	3 37	....	105	9 75	19 25
New Mexico	110	1 02	1 73	....	110	7 00	24 00
Utah	104	1 79	2 56	235	107	11 05	21 95
Washington	103	1 75	2 82	170	103	3 50	8 82
Wyoming	135	2 00	3 50	....	105	8 00	25 00
Indian Territory	....	....	....	....	80	1 50	5 00

Table showing the estimated total number and total value of each kind of live stock, and the average prices in January, 1883.

States and Territories.	Horses.			Mules.		
	Number.	Average price.	Value.	Number.	Average price.	Value.
Maine	89, 613	$72 26	$6, 475, 435	301	85 65	$25, 781
New Hampshire	47, 947	71 45	3, 425, 813	88	80 00	7, 040
Vermont	76, 119	72 29	5, 502, 643	295	90 77	26, 777
Massachusetts	60, 225	102 14	6, 151, 381	247	112 00	27, 664
Rhode Island	9, 758	100 95	985, 070	46	111 00	5, 106
Connecticut	46, 297	83 57	3, 869, 040	544	110 00	59, 840
New York	622, 627	91 98	57, 269, 231	5, 082	106 73	542, 402
New Jersey	88, 687	99 48	8, 822, 583	9, 286	117 65	1, 092, 498
Pennsylvania	546, 980	90 47	49, 485, 281	23, 213	106 07	2, 462, 203
Delaware	21, 999	85 32	1, 876, 955	4, 001	100 32	401, 380
Maryland	119, 212	80 37	9, 581, 068	12, 712	103 14	1, 311, 116
Virginia	221, 468	71 25	15, 779, 595	34, 002	98 40	3, 345, 797
North Carolina	135, 698	72 30	9, 810, 965	82, 281	91 66	7, 541, 876
South Carolina	61, 564	78 56	4, 836, 468	69, 028	95 61	6, 599, 767
Georgia	99, 704	76 17	7, 594, 454	133, 003	97 35	12, 947, 842
Florida	24, 956	75 20	1, 876, 691	10, 586	98 31	1, 040, 710
Alabama	116, 240	69 92	8, 127, 501	125, 961	80 26	10, 109, 630
Mississippi	114, 566	72 61	8, 318, 637	135, 008	80 85	10, 915, 397
Louisiana	105, 475	65 58	6, 917, 050	74, 343	77 47	5, 759, 352
Texas	880, 260	37 68	33, 168, 197	143, 386	52 50	7, 527, 765
Arkansas	156, 752	56 96	8, 928, 594	96, 008	67 99	6, 527, 584
Tennessee	269, 318	65 17	17, 551, 454	176, 427	76 01	13, 410, 216
West Virginia	125, 257	65 27	8, 175, 524	6, 349	75 40	478, 715
Kentucky	370, 028	70 65	26, 142, 478	116, 107	74 17	8, 611, 656
Ohio	717, 242	76 77	55, 062, 668	20, 572	83 83	1, 724, 551
Michigan	400, 005	78 91	31, 564, 395	5, 339	94 45	504, 269
Indiana	593, 131	72 85	43, 209, 593	51, 779	81 77	4, 233, 969
Illinois	1, 017, 915	75 38	76, 730, 433	123, 265	82 65	10, 187, 852
Wisconsin	377, 521	76 39	28, 838, 829	7, 423	95 04	705, 482
Minnesota	289, 056	77 26	22, 332, 467	9, 755	97 07	946, 918
Iowa	856, 897	73 99	63, 401, 809	47, 124	91 59	4, 316, 087
Missouri	687, 943	58 98	40, 574, 878	194, 917	68 00	13, 254, 356
Kansas	488, 734	61 22	29, 920, 295	70, 824	82 12	5, 816, 067
Nebraska	258, 865	76 29	19, 748, 887	23, 325	90 51	2, 111, 146
California	240, 567	54 89	13, 204, 723	30, 066	70 98	2, 134, 085
Oregon	135, 450	58 58	7, 934, 661	2, 860	68 58	196, 139
Nevada	37, 100	50 51	1, 873, 921	1, 339	69 45	92, 994
Colorado	47, 700	62 39	2, 976, 003	3, 132	90 45	283, 289
Arizona	7, 704	55 00	423, 720	1, 064	65 00	69, 160
Dakota	72, 000	73 23	5, 272, 560	3, 520	96 92	341, 158
Idaho	28, 400	60 00	1, 704, 000	780	70 00	54, 600
Montana	39, 900	61 06	2, 436, 294	929	96 09	89, 268
New Mexico	16, 640	42 92	714, 189	10, 082	53 24	536, 766
Utah	44, 100	48 53	2, 140, 173	3, 060	70 27	215, 026
Washington	55, 640	61 30	3, 410, 732	840	95 54	80, 254
Wyoming	14, 850	60 20	893, 970	780	78 00	60, 840
Total	10, 838, 111	70 59	765, 041, 308	1, 871, 079	79 49	148, 732, 390

Table showing the estimated total number and total value of each kind of live stock, and the average prices in January, 1883.

Sates and Territories.	Milch cows.			Oxen and other cattle.		
	Number.	Average price.	Value.	Number.	Average price.	Value.
Maine	152, 054	$32 08	$4, 877, 892	179, 923	$31 62	$5, 689, 165
New Hampshire	92, 385	32 00	2, 956, 320	144, 678	33 15	4, 796, 076
Vermont	225, 801	30 33	6, 848, 544	187, 933	32 89	6, 181, 116
Massachusetts	152, 699	39 29	5, 999, 544	110, 605	34 28	3, 791, 539
Rhode Island	21, 832	36 00	787, 752	13, 563	36 10	489, 624
Connecticut	121, 006	34 71	4, 200, 118	118, 167	33 44	3, 951, 504
New York	1, 481, 278	37 93	56, 184, 875	894, 991	34 16	30, 572, 893
New Jersey	159, 773	39 63	6, 331, 804	70, 654	33 88	2, 393, 758
Pennsylvania	867, 011	35 89	31, 117, 025	875, 994	29 76	26, 069, 581
Delaware	27, 566	32 50	895, 895	26, 005	28 36	737, 502
Maryland	123, 515	30 07	3, 714, 096	136, 855	25 92	3, 547, 282
Virginia	245, 353	22 11	5, 424, 755	441, 232	20 07	8, 855, 526
North Carolina	236, 706	17 18	4, 066, 609	428, 069	10 68	4, 571, 777
South Carolina	140, 574	18 89	2, 655, 443	228, 295	10 23	2, 335, 458
Georgia	321, 406	17 18	5, 521, 755	598, 834	10 09	6, 042, 235
Florida	43, 447	14 12	613, 472	560, 000	9 11	5, 101, 600
Alabama	276, 899	15 46	4, 280, 859	484, 950	10 47	5, 077, 426
Mississippi	277, 605	16 60	4, 608, 243	433, 504	10 84	4, 699, 183
Louisiana	147, 889	19 97	2, 953, 343	285, 898	10 98	3, 139, 160
Texas	660, 715	22 64	14, 958, 588	4, 410, 000	14 79	65, 223, 900
Arkansas	257, 752	21 51	5, 544, 246	429, 465	12 66	5, 437, 027
Tennessee	306, 810	22 50	6, 903, 225	485, 504	15 02	7, 292, 270
West Virginia	158, 214	28 91	4, 573, 967	289, 519	23 16	6, 705, 260
Kentucky	304, 720	30 25	9, 217, 780	503, 927	24 69	12, 441, 958
Ohio	774, 253	35 00	27, 098, 855	1, 028, 101	30 59	31, 449, 610
Michigan	400, 077	34 87	13, 950, 685	507, 002	29 36	14, 885, 579
Indiana	499, 795	31 55	15, 768, 532	842, 926	25 79	21, 739, 062
Illinois	883, 318	33 01	29, 158, 327	1, 428, 064	25 84	36, 901, 174
Wisconsin	517, 217	33 20	17, 171, 604	689, 640	25 62	17, 668, 577
Minnesota	321, 368	30 88	9, 923, 844	414, 645	24 86	10, 308, 075
Iowa	1, 014, 091	30 85	31, 284, 707	1, 917, 461	24 76	47, 476, 334
Missouri	681, 379	25 22	17, 184, 378	1, 376, 373	20 35	28, 009, 191
Kansas	487, 901	30 80	15, 027, 351	1, 280, 000	24 67	31, 577, 600
Nebraska	226, 145	32 18	7, 277, 346	1, 190, 000	25 58	30, 440, 200
California	214, 280	36 17	7, 750, 508	575, 000	27 48	15, 801, 000
Oregon	62, 491	31 43	1, 964, 092	515, 000	22 18	11, 422, 700
Nevada	14, 980	36 00	539, 280	212, 000	18 00	3, 816, 000
Colorado	39, 195	39 08	1, 531, 741	696, 000	26 95	18, 757, 200
Arizona	10, 044	23 50	236, 034	145, 000	19 00	2, 755, 000
Dakota	60, 750	30 84	1, 873, 530	220, 000	26 49	5, 827, 800
Idaho	15, 400	36 00	554, 400	195, 000	25 00	4, 875, 000
Montana	13, 960	37 00	516, 520	590, 000	25 10	14, 809, 000
New Mexico	15, 795	29 33	463, 267	375, 000	19 26	7, 222, 500
Utah	35, 070	28 17	987, 922	103, 000	23 02	2, 371, 060
Washington	31, 200	31 36	978, 432	117, 300	23 99	2, 814, 027
Wyoming	3, 916	25 00	97, 900	780, 000	23 46	18, 298, 800
Indian				510, 000	14 08	7, 180, 800
Total	13, 125, 685	30 21	396, 575, 405	28, 046, 077	21 80	611, 549, 109

Table showing the estimated total number and total value of each kind of live stock, and the average prices in January, 1883—Continued.

States and Territories.	Sheep.			Hogs.		
	Number.	Average price.	Value.	Number.	Average price.	Value.
Maine	577,236	$3 19	$1,841,383	71,416	$11 87	$847,708
New Hampshire	211,804	3 21	679,891	54,511	12 13	661,218
Vermont	448,712	4 56	2,046,127	74,864	11 67	873,663
Massachusetts	69,346	3 87	268,369	80,908	14 31	1,157,793
Rhode Island	21,729	4 00	86,916	14,405	13 39	192,883
Connecticut	59,425	3 85	228,786	62,406	10 38	647,774
New York	1,732,332	4 08	7,067,915	744,238	10 96	8,156,848
New Jersey	117,008	4 44	519,516	214,688	12 75	2,737,272
Pennsylvania	1,803,336	3 64	6,564,143	1,060,856	9 24	9,802,309
Delaware	22,077	3 36	74,179	46,740	7 80	364,572
Maryland	173,760	3 67	637,699	325,413	7 94	2,583,779
Virginia	502,262	2 73	1,371,175	773,864	5 36	4,147,911
North Carolina	466,162	1 39	647,965	1,311,821	4 15	5,444,057
South Carolina	120,078	1 75	210,136	584,601	4 34	2,537,168
Georgia	532,760	1 59	847,088	1,412,604	4 04	5,706,920
Florida	102,000	1 77	180,540	320,000	2 75	880,000
Alabama	350,944	1 53	536,944	1,225,534	4 34	5,318,818
Mississippi	293,477	1 61	472,498	1,070,269	4 05	4,334,589
Louisiana	128,849	1 69	217,755	564,439	4 30	2,427,088
Texas	7,877,500	2 40	18,906,000	1,953,189	3 98	7,773,692
Arkansas	239,256	1 80	430,661	1,250,513	3 88	4,851,990
Tennessee	675,478	1 82	1,229,370	1,988,753	5 56	11,057,467
West Virginia	684,925	2 67	1,828,750	404 406	5 92	2,394,084
Kentucky	1,000,169	2 65	2,650,448	1,916,587	5 73	10,982,044
Ohio	5,050,541	3 11	15,707,183	2,714,112	8 07	21,902,884
Michigan	2,436,790	3 21	7,822,096	934,184	8 45	7,893,855
Indianna	1,122,631	2 83	3,177,045	2,724,383	7 64	20,814,286
Illinois	1,149,906	2 87	3,300,230	3,970,764	7 46	29,621,899
Wisconsin	1,363,677	2 58	3,518,287	1,162,238	9 76	11,343,443
Minnesota	281,085	2 79	784,727	424,057	7 45	3,159,225
Iowa	497,161	2 82	1,401,994	5,107,445	8 02	40,961,709
Missouri	1,453,919	2 03	2,951,456	3,892,920	5 56	21,644,635
Kansas	747,008	2 40	1,792,819	1,984,646	8 57	17,008,416
Nebraska	324,111	2 45	794,072	1,526,823	7 96	12,153,511
California	5,907,680	2 02	11,933,514	856,000	7 14	6,111,840
Oregon	2,403,157	2 15	5,166,788	168,954	5 49	927,557
Nevada	367,000	2 09	767,030	12,000	11 40	136,800
Colorado	1,212,000	2 22	2,690,640	12,100	11 58	140,118
Arizona	602,000	2 10	1,264,200	9,200	8 00	73,600
Dakota	140,000	2 98	417,200	109,600	8 81	965,576
Idaho	125,000	2 60	325,000	23,600	11 00	259,600
Montana	405,000	3 04	1,231,200	17,200	10 60	182,320
New Mexico	3,960,000	1 50	5,940,000	19,300	10 80	208,440
Utah	513,000	2 30	1,179,900	22,500	12 42	279,450
Washington	390,000	2 45	955,500	50,300	5 42	272,626
Wyoming	520,000	3 06	1,591,200	735	10 59	7,784
Indian	55,000	2 00	110,000			
Total	49,237,291	2 53	124,365,835	43,270,086	6 75	291,951,221

WINTERING OF FARM ANIMALS.

CONDITION IN APRIL, 1883.

At the close of each winter an investigation is made to ascertain the degree of immunity from disease enjoyed by stock during the previous year, and their condition on emerging from "winter quarters." So large a portion of the cattle and sheep are unhoused that their condition depends on the comparative severity of the winter and the character of their winter feed as well as upon their status at the beginning of the winter months. It is probable that more losses occur on the plains in a moderate winter preceded by a summer and autumn range on which the grass is poor or too closely fed, than in a severe winter entered upon by cattle in high condition.

HORSES.

The usual returns of April showed that the condition of horses throughout the country was unusually good. Health and medium condition were nearly universal. There were in all parts of the country mild cases of pink-eye, or colds and inflammations popularly known under that name. The fatal cases were few, and were perhaps more numerous than elsewhere in Maine, New York, Pennsylvania, South Carolina, Mississippi, Texas, Tennessee, Indiana, and Michigan. Skill in the care of the sick animal gained by experience, a dry winter, and abundant food have united to prevent death and maintain condition. Fatal diseases were few. In Hamilton County, New York, there were some deaths from inflammation of the lungs. In Camden, New Jersey, overworked and poorly-cared-for horses have suffered from epizootic, and fatal cases of disease induced by the water drank. The malady disappeared with a change in the drinking water. In Pennsylvania deaths from lung fever occurred in Juniata County, glanders in Allegheny, quinsy in Clarion, and an obscure disease in Jefferson. Bots were fatal in Choctaw, Union, and Tate Counties, Mississippi. In Louisiana, colic, charged to Western corn, was fatal in Richland and Red River. Impoverishment from lack of food was noted in parts of Texas.

In Clark County, Illinois, the "Texan itch," deemed contagious, prevailed, in which the affected animal may linger for a year, but death invariably occurs. The same disease was reported in Clarke County, Iowa. In Louisa County "50 per cent. of foals failed owing to pink-eye in 1882." Glanders was reported in Morrison County, Minnesota, and something resembling it in Amador, California.

CATTLE.

The reports of the comparative condition of cattle and extent of shelter for them in winter showed a high state of health and flesh, with rare exceptions. In New England and the North Middle States, farmers protect stock against the rigors of the winter. In Maryland and Virginia the practice is not so general, nor the provision so thorough, though few owners leave their milch cows exposed. A Virginia correspondent speaks of the "improvident and unmerciful neglect" which leaves three-fourths of the animals to the mercy of a capricious winter.

In the Southern and Southwestern States, where the milder winters and lower value of cattle limit attention to the advantages of shelter, there is claimed to be a growing tendency to make some provision of food and shelter, and the condition of cattle proves the wisdom of the new custom. Improved breeds imported into South Carolina, Louisiana, and Texas for dairy purposes are carefully sheltered. The native animals receive less attention. February and March were unusually cold in Georgia and Texas, causing some deaths in Worth County, Georgia, and impoverishment in De Kalb, McDuffie, Berrien, and Fannin. In Texas, the Karnes County correspondent estimates the losses from stress of weather in February at 10 per cent.; 3 per cent. were frozen in Menard, and "losses were heavy" in Austin. There was also damage from lack of protection in Angelina, Williamson, Chambers, Galveston, Llano, Bandera, Tarrant, Brazoria, and Jefferson. In Alabama and Mississippi shelter is unusual, but food was plenty, and there were few long or severe storms, and vigor and flesh were not diminished by the exposure, except in Bullock and Baldwin Counties, Alabama.

Condition of stock in Arkansas and Tennessee was better than usual. Storms did injury in some counties, but in others cattle wintered better than in ordinary seasons. In both States winter protection is increasing. In West Virginia shelter is not common except that provided by nature, and high condition in spring is unusual. In Ohio and Michigan the localities that show no provision against storm are small and rare. Feed was abundant and stock in unusual condition of flesh and health. In Kentucky, Illinois, and Indiana shelter is not so general, although few counties report "spring-poor" cattle. In Wisconsin, Iowa, and Minnesota, where shelter is a necessity, stock was vigorous with hardly an exception. Impoverishment from winter's severity was reported from some counties. The cattle of Missouri are not generally sheltered; milch cows are sometimes provided with sheds, but straw-stacks, trees, ravines, and the fence are the main protections.

The provision of shelter in Kansas is checked by the high price of lumber and the scarcity of timber. Farmers in mixed agriculture protect their few cattle in some way, if only by arrangement of stacks, or by pole-sheds covered and banked thick with grass or straw. But in the west two-thirds of the State, where larger herds are common, a conspicuous absence of shelter is observed. There is a lessening faith, however, in the considerate nature of a Kansas winter, and the losses from severe weather are yearly decreasing. In Nebraska loss of condition from stress of weather was reported in several counties.

Grass on the ranges in California was light, and reduced the flesh of cattle in San Joaquin, San Diego, Yuba, and Stanislaus. In Garfield County, Washington, snow interfered with grazing, but no deaths occurred. The correspondent at Chickasaw Nation, Indian Territory, says: "Thousands have died from want of care and attention, not being provided with proper shelter." But from the Territories generally the condition is reported unusually high and losses small.

Abortion was prevalent to some extent in the dairy regions of the East. It is an old obstacle to success in dairying, which is annually reported. There is no evidence that it is more general than in some former years.

"Texas fever," known also as "Spanish" and "splenic" fever, was fatal in several parts of Virginia. In Halifax County 10 or 12 per cent. of the cattle died from it.

In Louisiana there was much loss from the overflow of the Mississippi River. In several localities there was great destruction by the buffalo gnats. Some losses in Texas resulted from eating the "loco weed," *Astragalus molissimus.*

Black-leg in the Western States and on the Pacific coast caused the death of young cattle to some extent. In Leelenaw County, Michigan, a disease prevailed, known as the Michigan fever, affecting the digestive organs and spine. "The animal wastes to a skeleton, and three-fourths of the sick die."

SHEEP.

Sheep shared with other farm animals in the general good fortune of the year. Exemption from fatal disease was general. Excessive rains in Georgia, unusual cold weather and scab in Texas, scab in Kansas, and dogs everywhere, but particularly in Tennessee, were the principal enemies of the year. In Louisiana, Texas, and elsewhere there were losses of lambs, sometimes in quite serious proportion to births. There was some loss from foot-rot in the Northwest. California, the Plains, Nebraska, and Kansas reported comparatively few losses; yet, losses from

all causes combine to constitute an obstacle which is a bar to extension of sheep husbandry in half the country, and almost to its annihilation as a rural pursuit. Dogs do the principal mischief. There are other serious causes, the principal of which is the loss by storms and exposure to severe cold. In the South theft is the cause of decrease of numbers and discouragement of flock-owners in some localities. The losses in these States run from 15 to 20 per cent., and sometimes higher.

The loss for the whole country, according to these returns, averages 8 per cent., and aggregate nearly 5,000,000 sheep per annum. While it is not assumed that these figures represent exactly the real losses, they probably do not understate them, as they are well substantiated by the census returns of losses of sheep in 1879. The following is the percentage of loss for each State:

States.	Per cent.	States.	Per cent.	States.	Per cent.
Maine	5	Florida	8	Iowa	8
New Hampshire	7	Alabama	16	Missouri	7
Vermont	5	Mississippi	16	Kansas	10
Massachusetts	4	Louisiana	21	Nebraska	5
Rhode Island	6	Texas	23	California	6
Connecticut	5	Arkansas	12	Oregon	10
New York	5	Tennessee	13	Nevada	8
New Jersey	8	West Virginia	5	Colorado	7
Pensylvania	5	Kentucky	7	Arizona	11
Delaware	5	Ohio	7	Dakota	7
Maryland	5	Michigan	3	Montana	8
Virginia	9	Indiana	7	New Mexico	9
North Carolina	17	Illinois	6	Utah	4
South Carolina	9	Wisconsin	4	Washington	11
Georgia	19	Minnesota	7	Wyoming	10

The disproportion of these losses, from 4 per cent. in Massachusetts to 19 in Georgia, results from neglect which is avoidable.

SWINE.

The losses of swine from all causes during the past year amount to about 6 per cent., according to returns of correspondents. They are very large in the South, and less than in some former years in the Western States. The percentages of loss are as follows:

States.	Per cent.	States.	Per cent.	States.	Per cent.
Maine	5	Georgia	21	Illinois	5
New Hampshire	2	Florida	17	Wisconsin	5
Vermont	4	Alabama	10	Minnesota	4
Massachusetts	3	Mississippi	31	Iowa	5
Rhode Island	1	Louisiana	35	Missouri	6
Connecticut	3	Texas	18	Kansas	1
New York	4	Arkansas	19	Nebraska	4
New Jersey	5	Tennessee	17	California	1
Pennsylvania	6	West Virginia	10	Oregon	2
Maryland	5	Kentucky	10	Arizona	3
Virginia	18	Ohio	4	Dakota	1
North Carolina	23	Michigan	2	New Mexico	1
South Carolina	7	Indiana	5	Washington	2

These percentages indicate a loss during the past year of nearly 4,000,000 swine of all ages from "cholera" and other forms of disease.

RECENT IMPROVEMENT IN CATTLE.

The quantity of beef produced at the present time, in comparison with the beef product of thirty to fifty years ago, cannot be shown by comparing the numbers of cattle at different dates. There are cattle in the Gulf States, east of the Mississippi, and but little beef. Counting out the numbers that die, and taking account of the average age before reaching the dignity of beeves, there is still to be considered the thinness and lightness of carcass. Thus, with a low ratio of slaughtered beeves to number of cattle and small weight, the quantity is relatively small. The value is still smaller, from deficiency in quality. The difference is better illustrated by reference to exports. From Key West, Florida, were shipped in 1882, 27,291 cattle, valued at $410,758, while from New York were exported 33,412, worth $3,332,004. It is the difference between the wild Spanish stock and the English Short-horn grade, one at $15.05, the other six or seven times as much, averaging $99.72. These cases represent extremes—the poorest cattle of the export trade and the highest improvement of the country, equal to average English beeves.

The spirit of improvement is rife, and never so extended geographically as at present. It has reached the great plains, the fastnesses of the Rocky Mountains, the slopes of the Pacific, the prairies of Texas, and the forest pastures of the Southern Atlantic and Gulf States. It has made less progress in the latter, from the difficulty of acclimatizing Northern stock in the lower areas of the South. Cattle introduced among lowland stock soon become diseased and most of them die, just as they do when Texas cattle come among them in Northern pastures.

In the Territories the demand for high-grade Short-horns or Herefords is now beyond all precedent. The value of superior blood was never before so generally recognized.

The improvement already attained has more than doubled the value of the cattle of the country. There is room for further advances, which are sure to follow the necessary effort to make meat production pay as the values of pasturage and prepared feed advance. The aim of breeders and readers is at present very manifestly in the direction of

EARLIER MATURITY.

The improvement of cattle, by a larger infusion of Short-horn blood, and more recently by importation of Herefords, has advanced maturity, reducing the average age at which cattle are sent to the butcher. An inquiry concerning the extent of this improvement brings abundant evidence that it is general in all the States, though differing in degree. It is very marked in the cattle-growing region of the West and in the Atlantic States down to North Carolina. It is not so positive a gain in New England, as beef is of less importance than milk, and in a measure incidental to beef production, the product of cows advancing in age. The Massachusetts reports, for instance, average between four and five years as the age of native cattle slaughtered for beef. Maine, New Hampshire, and Vermont make an average of nearly four years; Rhode Island and Connecticut, four; New York, another dairy State, averages four; New Jersey four and a half, and Pennsylvania between three and four. There is some variation in the Southern States, but most of them average about four years, Georgia and Alabama making a figure somewhat less. Florida and Texas make an average of three and a half, as

do Arkansas, Tennessee, and West Virginia. The States of the Ohio Valley come very near three years, Indiana requiring slightly more time than Ohio and Illinois. West of the Mississippi the average is nearly three and a half years, including the Pacific coast region. The mountain section ranges from three to three and a half. The returns are not sufficiently complete and nicely discriminating to make it practicable to indicate by minute fractions the exact differences between the States. It is difficult for correspondents to fix a figure that will show the true average, and these results are therefore presented as an embodiment of local views, the general accuracy and consistency of which may be canvassed by the intelligent reader.

In Illinois three-fourths of the correspondents report a decrease in the average age of beeves in the past ten years. The Winnebago correspondent says that steers at three years old average as much as steers of four years in 1873. In some counties where feeding is less in vogue than formerly, as in Peoria, where distillers consume a large amount of corn, it is claimed that average earliness and weight have both declined. In Dubois, Indiana, a year's gain is claimed in time of maturing. It is noted in many counties that young stock is better fed and cared for, insuring steady growth and early maturity. The Tippecanoe correspondent claims that feeders market their cattle at half the age of former times. The high prices of the past year have called out numbers of cattle at an unusually early age, at the expense of weight. In Belmont, Eastern Ohio, the gain in time of maturity is fixed at six months. Improvement by feeding is the cause of earlier maturity in Texas, and is now in rapid progress at many points, looking to the ultimate conversions of long-horns into short-horns. There is much evidence of improvement in other parts of the South, though beef production can scarcely be reckoned an industry in the cotton-growing belt. Such is the brief but accurate generalization of the average views of correspondents on this important subject.

WEIGHT OF BEEVES.

Previous reports of correspondents, and the records of meat markets, have indicated a tendency to increase of average weight of cattle slaughtered, as well as an earlier average age at which cattle are sent to the shambles. It has become an appreciated fact in the experience of average cattle-raisers that with increasing values of farms and forage a given weight of feed must produce a larger weight of net beef than heretofore. To do this, quicker work is required, a shorter time for maturing, and a greater average weight. This investigation was undertaken to ascertain, as nearly as possible, the measure of this evident improvement of recent years. It is a work attended with difficulties. In the dairy States old cows are fattened for beef, and must be counted as beef, greatly reducing the average live weight.

The average for the South is smallest. Cattle are there a mixed race, degenerated English mixed with the Spanish stock of Texas and Florida, small, left largely to care for themselves, kept mainly for milk for family use, but not remarkable for milking qualities as a rule. There are notable exceptions and considerable improvement already indicated. Of course the average weight is low. The estimates are furnished by our large corps of correspondents, and are given as the deliberate opinion of those assumed to be best qualified to judge. A better showing will doubtless be made in ten years.

The highest averages are in the Western States, the region of prairie grasses and cheap corn. In sections where feeding for export is practiced average weights are much greater than elsewhere. Some coun-

ties report averages of 1,300 to 1,500 pounds. The correspondent for Whiteside, Ill., says that while butcher's stock has not varied much, well-matured cattle weigh 300 pounds more than the weights of ten years ago. The correspondent of Parke, Indiana, makes the average 1,400 pounds, or 200 more than in 1873. In Johnson, Indiana, where the estimated average is 1,200 pounds, it is said that in 1873 the average was 50 to 100 pounds greater, from the custom then prevailing of making heavy weights. The popular idea now is "to push from the start and save one winter's feeding, thereby making greater profits." This is true policy, which feeders of the West are beginning to see and to practice. In White, Illinois, where the average is placed at 1,200 pounds, the time is so much shortened that the average weight is less than ten years ago.

West of the Mississippi the tendency is strong towards earlier maturity. In Appanoose, Iowa, half the stock is "fattened at two years old" and weighs as much as formerly at three. In Des Moines "beef cattle are heavier in 1883 than they were in 1873, because it is more profitable to push them from the start." In Texas weight has increased from amelioration of blood. Shipping facilities at some points save the shrinkage caused by driving long distances.

The following table shows the average weights from consolidation of returns of correspondents:

States.	Average weight.		States.	Average weight.	
	1883.	1873.		1883.	1873.
Maine	840	720	West Virginia	950	900
New Hampshire	900	775	Kentucky	1,062	996
Vermont	950	820	Ohio	1,100	1,007
Massachusetts	975	845	Michigan	985	903
Rhode Island	950	850	Indiana	1,112	1,018
Connecticut	900	825	Illinois	1,128	1,050
New York	926	869	Wisconsin	1,043	975
New Jersey	985	930	Minnesota	1,026	960
Pennsylvania	931	920	Iowa	1,120	1,060
Delaware	875	850	Missouri	1,026	1,006
Maryland	925	900	Kansas	1,090	1,035
Virginia	874	827	Nebraska	1,100	1,042
North Carolina	607	569	California	687	572
South Carolina	518	502	Oregon	683	620
Georgia	554	536	Nevada	637	600
Florida	554	541	Colorado	825	675
Alabama	531	526	Arizona	591	575
Mississippi	525	500	Dakota	875	650
Louisiana	611	575	New Mexico	700	600
Texas	789	750	Utah	880	830
Arkansas	680	650	Washington	800	770
Tennessee	874	716	Wyoming	880	700

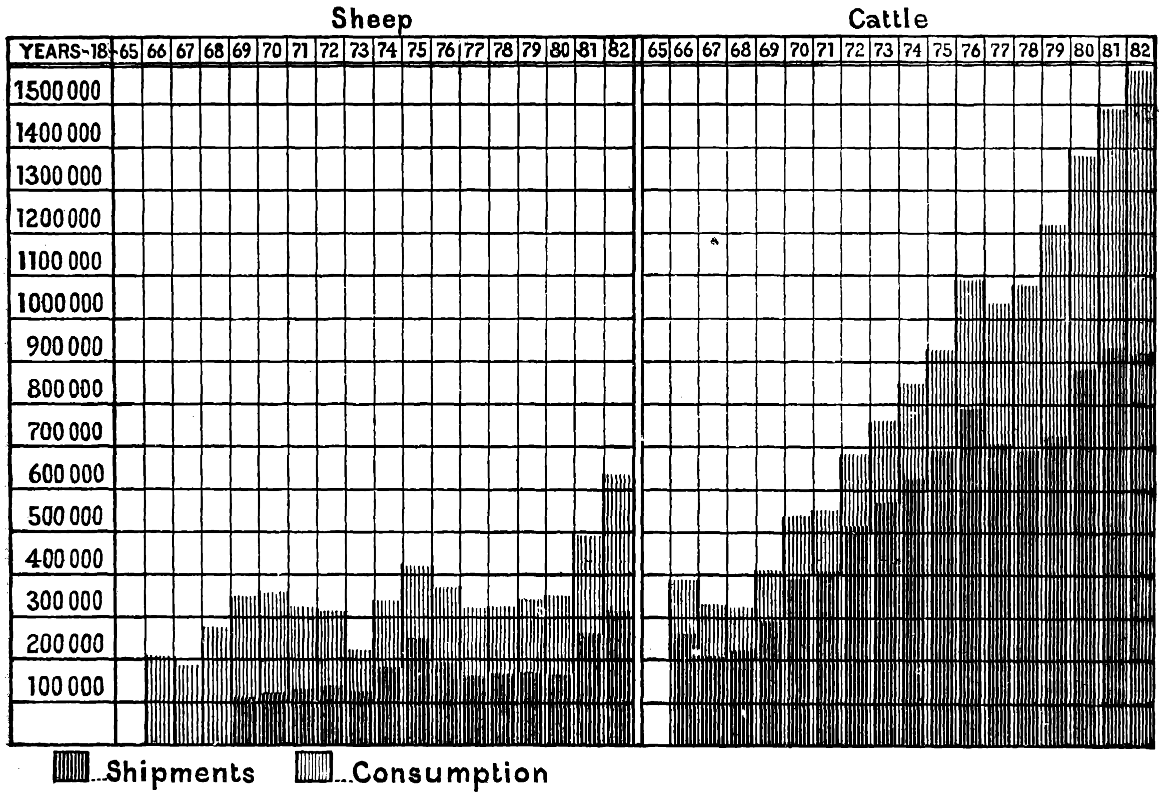
STOCK STATISTICS.

THE CHICAGO MARKET.

The volume of business in this great stock market is rapidly increasing. There were 1,582,530 cattle, exclusive of calves, received, and 661,521 retained for home consumption or slaughter and cutting, or shipment as dressed beef. In 1870 the difference between receipts and shipments was only 141,255. The receipts and shipments, and home consumption, for seventeen years, are thus presented:

	Cattle.	Calves.	Hogs.	Sheep.	Horses.
Receipts	14,629,013	73,913	66,334,665	5,788,920	149,778
Shipments	9,848,754	43,694	22,855,706	2,641,171	133,655
Total	4,780,259	30,219	43,478,959	3,147,749	16,123

D.—*Showing receipts, shipments, and consumption of cattle and sheep in Chicago.*



Of these receipts, 8,892,253, or 61 per cent. of the whole number of cattle, were handled in the last seven years. The increase has been comparatively steady, amounting to nearly half a million since 1876, stimulated by the demand for the packing and canning trade, and more recently the dressed-beef trade. This increase is shown clearly in Diagram D, which displays graphically the receipts of seventeen years, and the relative proportions shipped and retained. The proportions, year after year, run in nearly parallel lines until 1876, when the light shading indicating consumption suddenly encroaches on the dark space showing shipments.

The receipts of sheep have doubled in ten years, and the increase in seventeen has been about 200 per cent. Formerly, much the larger proportion were for city consumption; now, while the number retained has greatly increased, the shipments are about half of the aggregate.

The swine receipts have increased with still more wonderful rapidity. As "hogs" and "corn" are in a sense reciprocal terms, the six years of fat corn crops nearly doubled Chicago receipts. So the poor corn year, 1881, reduced the next year's receipts 657,340, as the bad crop of 1874 checked the tendency to increase and made the following year's receipts less by 346,269.

Total receipts for seventeen years.

Years.	Cattle.	Calves.	Hogs.	Sheep.	Horses.
1865 (five days)	613	....	17,764	1,433	....
1866	393,007	....	961,746	207,987	1,553
1867	329,188	....	1,696,738	180,888	847
1868	324,524	....	1,706,782	270,891	1,902
1869	403,102	....	1,661,869	340,072	1,524
1870	532,964	....	1,693,158	349,853	3,537
1871	543,050	....	2,380,083	315,053	5,963
1872	684,075	....	3,252,623	310,211	12,145
1873	761,428	....	4,437,750	291,734	20,289
1874	843,966	....	4,258,379	333,655	17,588
1875	920,843	....	3,912,110	418,948	11,346
1876	1,096,745	....	4,190,006	364,095	8,159
1877	1,033,151	....	4,025,970	310,240	7,874
1878	1,083,068	....	6,339,654	310,420	9,415
1879	1,215,732	....	6,448,330	325,119	10,473
1880	1,382,477	....	7,059,355	335,810	10,398
1881	1,498,550	*48,948	6,474,844	493,624	12,909
1882	1,582,530	24,965	5,817,504	628,887	13,856
Total	14,629,013	73,913	66,334,665	5,788,920	149,778

* Prior to 1881 calves were classed with cattle.

Total shipments for seventeen years.

Years.	Cattle.	Calves.	Hogs.	Sheep.	Horses.
1866	263,693	....	482,875	75,447	162
1867	203,580	....	758,789	50,275	387
1868	215,987	....	1,020,329	81,634	2,185
1869	294,717	....	1,086,305	108,690	1,538
1870	391,709	....	924,453	116,711	3,488
1871	401,927	....	1,162,286	135,084	5,482
1872	510,025	....	1,835,594	145,016	10,625
1873	574,181	....	2,197,557	115,235	18,540
1874	622,929	....	2,330,361	180,555	16,608
1875	696,534	....	1,582,643	243,604	11,129
1876	797,724	....	1,131,635	195,925	6,839
1877	703,402	....	951,221	155,354	6,598
1878	699,108	....	1,266,906	156,727	8,176
1879	726,903	....	1,692,361	159,266	9,289
1880	886,614	....	1,394,990	156,510	8,713
1881	928,712	*33,465	1,289,679	253,938	11,108
1882	921,009	10,229	1,747,722	314,200	12,788
Total	9,848,754	43,694	22,855,706	2,641,171	133,655

* Prior to 1881, calves were classed with cattle.

The Chicago, Burlington and Quincy Railroad transported about one-third of the cattle to Chicago. It runs through a corn belt, perhaps unsurpassed in the United States, which continues to maintain its superiority as a source of cattle supply. The Chicago and Northwestern still maintains second rank as a feeder to the great cattle mart. Chicago, Rock Island and Pacific is third, and Chicago and Alton fourth, as in the previous year, while the Wabash has changed places with the Milwaukee and Saint Paul during the last year. The receipts come by the following routes:

Total receipts by railway lines for 1882.

Roads.	Cattle.	Calves.	Hogs.	Sheep.	Horses.
	Number.	*Number.*	*Number.*	*Number.*	*Number.*
Baltimore and Ohio	1, 260	853	22, 891	8, 526	176
Chicago and Alton	199, 141	296	335, 723	66, 639	1, 723
Chicago, Burlington and Quincy	491, 800	2, 174	1, 555, 688	168, 181	2, 416
Chicago and Eastern Illinois	26, 403	636	98, 439	15, 013	320
Chicago and Grand Trunk	1, 951	802	12, 575	1, 300	542
Chicago, Milwaukee and Saint Paul	154, 873	4, 067	735, 203	94, 044	866
Chicago and Northwestern	223, 678	5, 420	1, 061, 616	111, 344	880
Chicago, Rock Island and Pacific	212, 884	601	859, 381	42, 460	1, 631
Illinois Central	95, 415	967	592, 212	36, 368	1, 032
Lake Shore and Michigan Southern	4, 474	4, 527	54, 235	11, 362	1, 764
Louisville, New Albany and Chicago	7, 641	388	18, 976	3, 418	59
Michigan Central	3, 030	1, 549	39, 279	7, 804	728
New York, Chicago and Saint Louis	24	3	2, 761	....	....
Pittsburgh, Cincinnati and Saint Louis	5, 127	373	46, 595	4, 596	301
Pittsburgh, Fort Wayne and Chicago	3, 286	1, 834	29, 071	2, 763	159
Wabash, Saint Louis and Pacific	146, 104	373	351, 961	54, 590	1, 259

Total shipments by railway lines for 1882.

Railroads.	Cattle.	Calves.	Hogs.	Sheep.	Horses.
	Number.	*Number.*	*Number.*	*Number.*	*Number.*
Baltimore and Ohio	46, 002	3	27, 794	1, 035	290
Chicago and Alton	7, 349	837	514	2, 052	61
Chicago, Burlington, and Quincy	5, 257	1, 678	114	6, 029	198
Chicago and Eastern Illinois	3, 858	212	82	14	48
Chicago and Grand Trunk	47, 691	40	22, 241	47, 158	290
Chicago, Milwaukee and Saint Paul	13, 642	1, 082	280	6, 957	3, 654
Chicago and Northwestern	16, 764	1, 795	3, 825	6, 445	2, 560
Chicago, Rock Island and Pacific	21, 780	1, 342	....	2, 334	181
Illinois Central	10, 424	1, 410	2, 955	3, 263	95
Lake Shore and Michigan Southern	272, 778	831	865, 074	137, 602	3, 035
Louisville, New Albany and Chicago	706	139	263	....	35
Michigan Central	207, 901	28	559, 459	5, 037	1, 017
New York, Chicago and Saint Louis	342	....	510	384	....
Pittsburgh, Cincinnati and Saint Louis	5, 698	84	222	190	100
Pittsburgh, Fort Wayne and Chicago	258, 260	75	264, 302	94, 016	1, 191
Wabash, Saint Louis and Pacific	2, 557	673	87	1, 654	33

SHIPMENTS EASTWARD.

The shipments eastward have augmented more rapidly than population. Philadelphia has made the largest relative gain in cattle, though the absolute increase in numbers is, of course, made by New York. The receipts of veals in New York have increased from 91,529 in 1869 to 190,582 in 1882.

The New York Produce Exchange record of these shipments is as follows:

Receipts of cattle at the seaboard cities.

Years.	New York.	Boston.	Philadelphia.	Baltimore.	Total.
	Number.	*Number.*	*Number.*	*Number.*	*Number.*
1869	330, 308	127, 914	107, 517	89, 594	655, 333
1870	361, 076	124, 592	126, 738	89, 021	701, 427
1871	379, 372	129, 947	136, 483	100, 000	745, 802
1872	433, 664	157, 336	148, 152	91, 764	830, 916
1873	447, 445	167, 730	84, 265	84, 664	784, 104
1874	457, 709	163, 300	185, 140	130, 946	937, 095
1875	457, 057	145, 285	152, 830	112, 679	867, 851
1876	467, 722	189, 989	190, 550	110, 366	958, 627
1877	507, 832	155, 907	203, 470	112, 862	980, 071
1878	543, 587	188, 385	188, 600	117, 675	1, 038, 247
1879	575, 159	183, 556	216, 780	150, 829	1, 126, 324
1880	679, 987	230, 079	218, 606	138, 969	1, 267, 641
1881	592, 570	204, 928	225, 521	122, 174	1, 245, 193
1882	628, 843	130, 900	163, 300	92, 614	1, 015, 657

Receipts of sheep at the seaboard cities.

Years.	New York.	Boston.	Philadelphia.	Baltimore.	Total.
	Number.	*Number.*	*Number.*	*Number.*	*Number.*
1869	1, 470, 828	434, 299	536, 500	213, 901	2, 655, 528
1870	1, 463, 878	450, 997	682, 000	175, 000	2, 771, 875
1871	1, 316, 408	487, 065	790, 200	200, 000	2, 793, 673
1872	1, 179, 518	412, 217	749, 500	155, 558	2, 496, 793
1873	1, 206, 715	414, 076	753, 750	160, 000	2, 534, 541
1874	1, 165, 563	364, 281	757, 040	120, 000	2, 406, 884
1875	1, 233, 968	372, 370	491, 500	191, 485	2, 289, 323
1876	1, 211, 086	348, 510	548, 850	223, 267	2, 331, 713
1877	1, 184, 687	346, 647	545, 870	96, 786	2, 173, 990
1878	1, 349, 622	372, 787	650, 400	220, 135	2, 592, 944
1879	1, 507, 739	479, 227	619, 450	243, 520	2, 849, 936
1880	1, 656, 955	476, 785	623, 494	248, 047	3, 005, 281
1881	1, 738, 826	505, 828	645, 792	305, 496	3, 195, 742
1882	2, 066, 502	626, 608	614, 000	202, 241	3, 509, 357

In the record for swine the most noticeable change is the remarkable movement to Boston, which is now nearly equal to the aggregate receipts of Philadelphia and Baltimore.

Receipts of hogs at the seaboard cities.

Years.	New York.	Boston.	Philadelphia.	Baltimore.	Total.
	Number.	*Number.*	*Number.*	*Number.*	*Number.*
1869	901, 725	167, 558	176, 200	250, 516	1, 495, 999
1870	889, 625	189, 330	189, 500	300, 000	1, 568, 455
1871	1, 310, 280	351, 307	199, 610	350, 000	2, 211, 197
1872	1, 923, 727	602, 625	210, 276	314, 269	3, 050, 897
1873	1, 958, 389	854, 507	344, 300	392, 734	3, 549, 930
1874	1, 774, 221	587, 721	339, 590	357, 547	3, 059, 079
1875	1, 388, 517	331, 989	243, 300	279, 631	2, 243, 437
1876	1, 222, 657	361, 317	289, 900	259, 064	2, 132, 938
1877	1, 268, 596	330, 604	242, 400	322, 945	2, 164, 545
1878	1, 794, 539	510, 432	282, 060	260, 514	2, 847, 545
1879	1, 725, 537	582, 615	341, 450	356, 524	3, 006, 126
1880	1, 719, 137	691, 839	346, 960	336, 867	3, 094, 803
1881	1, 533, 526	708, 900	367, 876	338, 551	2, 948, 853
1882	1, 366, 848	816, 535	186, 800	268, 811	2, 638, 994

THE FOREIGN TRADE.

While the domestic distribution has been rapidly extending and enlarging, the foreign trade in all farm animals has increased, and espe-

cially the exportation of sheep and cattle. The cattle exports prior to 1878 were from Southern ports almost entirely. When the transportation to Europe commenced, from Northern ports, the numbers increased rapidly and values enormously.

The following statement exhibits the progress of stock exportation:

Years.	Cattle.		Swine.		Sheep.		Horses.		Mules.	
	Number.	Value.	Number.	Value.	Number.	Value.	Number.	Value.	Number.	Value.
1870	27,530	$439,987	12,058	$189,753	39,570	$95,193	2,121	$177,479	995	$140,850
1871	20,530	403,491	8,770	61,390	45,465	86,888	1,186	173,273	1,930	265,827
1872	28,033	565,719	56,110	548,153	35,218	79,592	1,722	268,475	2,121	294,402
1873	35,455	695,957	99,720	787,402	66,717	107,698	2,814	255,365	1,659	172,172
1874	56,067	1,150,857	158,581	1,625,837	124,248	159,735	1,432	169,303	1,252	174,125
1875	57,211	1,103,085	64,979	739,215	424,416	183,898	3,220	242,031	2,802	356,828
1876	51,593	1,110,703	68,044	670,042	110,312	171,101	2,030	234,964	1,784	224,860
1877	50,001	1,593,080	65,107	699,180	179,017	234,480	2,042	301,134	3,441	478,434
1878	80,040	3,896,818	29,284	267,259	183,995	333,499	4,104	798,723	3,860	501,513
1879	136,720	8,379,200	75,129	700,262	215,680	1,082,938	3,915	770,742	4,153	530,989
1880	182,756	13,344,195	83,434	421,089	209,137	892,647	3,060	675,139	5,198	532,362
1881	185,707	14,304,103	77,456	572,138	179,919	762,932	2,523	390,243	3,207	353,924
1882	108,110	7,800,227	36,368	509,651	139,676	603,778	2,248	470,183	2,632	320,130
1883	104,444	8,341,431	16,129	272,516	337,251	1,154,856	2,800	475,806	4,237	486,560

Domestic exports of horned cattle, by customs districts, 1870 *to* 1882, *inclusive.*

Years.	New York.		Boston.		Key West.		Saluria, Tex.		All others.	
	Number.	Value.	Number.	Value.	Number.	Value.	Number.	Value.	Number.	Value.
1870	1,201	$155,347			6,404	$74,796	2,045	$11,957	17,880	$197,887
1871	1,070	128,785	4	$250	7,171	98,102	219	1,836	12,066	174,518
1872	1,037	106,638			17,712	291,691	34	382	9,250	167,008
1873	990	98,675	6	600	17,008	278,244	276	3,030	17,175	315,408
1874	1,267	226,894	1	112	17,627	317,574	159	1,952	37,013	604,325
1875	1,564	234,938	3	340	11,453	178,682	10,546	159,139	33,645	529,986
1876	1,589	160,268	144	18,720	8,482	112,874	19,000	324,825	22,378	494,016
1877	4,863	485,183	1,566	175,575	9,071	120,244	17,830	306,500	16,671	505,578
1878	13,387	1,233,233	13,887	1,346,748	16,190	220,764	20,871	371,700	15,705	724,373
1879	27,210	2,340,997	35,593	3,515,069	25,466	346,300	21,441	368,878	27,010	1,807,956
1880	65,151	6,047,914	52,482	5,110,563	28,600	400,315	16,526	290,929	19,997	1,494,474
1881	56,921	5,330,502	70,072	6,984,838	22,580	318,189	15,705	264,476	20,429	1,406,098
1882	33,412	3,332,004	32,568	3,316,848	27,291	410,758	7,300	134,888	7,539	605,729
1883	29,584	2,988,083	37,613	3,785,782	19,399	330,435	2,015	46,413	15,833	1,190,718

The distribution of these exports, by countries, shows that the Short-horn grades go mainly to England, and the long-horn or Spanish stock to Cuba.

Number of cattle exported.

Countries to which exported.	1879.	1880.	1881.	1882.	1883.
	Number.	*Number.*	*Number.*	*Number.*	*Number.*
England	68,544	118,242	124,317	61,876	67,013
Scotland	3,250	7,275	9,744	6,132	9,078
Germany	1,330		207	6	
Belgium	1,816	3,342	2,093		189
France	118	1,240	1,297	110	
Cuba	49,228	45,515	38,941	34,603	20,784
British West Indies and Honduras	1,531	2,409	1,978	1,531	1,174
Dominion of Canada	8,555	2,840	4,658	2,803	3,821
Mexico	2,145	992	1,254	793	1,812
Other countries	203	991	1,218	256	573
Total	136,720	182,756	185,707	108,110	104,444

The increase in average price is due to the increasing proportion of Northern stock exported. The Texas and Florida cattle that go to the West Indies still sell for about $16, while the fat bullocks sent to supplement the roast beef of England are worth $100. In ten years this feature of the foreign cattle movement has advanced the average price at the shipping ports from $20.53 to $79.86.

Average value of cattle exported.

Years.	Mexico.	Cuba.	Canada.	England.	All countries.
1874	$8 29	$17 46	$25 96	$5,850 00	$20 53
1875	9 31	15 54	29 51	663 64	19 28
1876	8 94	16 34	34 52	113 82	21 53
1877	9 95	16 06	30 81	107 56	31 86
1878	8 50	17 02	45 98	97 02	48 69
1879	9 48	15 79	60 57	92 59	61 29
1880	10 72	15 47	32 73	94 71	73 02
1881	10 96	15 35	29 32	96 82	77 03
1882	23 46	15 85	44 30	102 27	72 15
1883	26 21	17 64	38 59	100 44	79 86

Exports of fresh beef.

Years.	England.	Scotland.	France.	Total exports.
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*
1877	39, 906, 940	9, 304, 050	....	49, 210, 990
1878	44, 800, 369	8, 746, 100	487, 690	54, 046, 771
1879	46, 962, 039	5, 830, 930	1, 039, 941	54, 025, 832
1880	70, 524, 881	13, 930, 000	....	84, 717, 194
1881	81, 637, 577	21, 714, 900	....	106, 004, 812
1882	49, 672, 848	15, 700, 093	....	69, 586, 466
1883	54, 279, 542	24, 791, 300	....	81, 064, 373

Exports of fresh beef by districts.

Years.	Boston.	New York.	Huron.	Total exports.
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*
1877	81, 000	39, 230, 400	....	49, 210, 990
1878	727, 025	43, 926, 387	....	54, 046, 771
1879	987, 158	44, 414, 227	....	54, 025, 832
1880	13, 668, 587	60, 689, 725	50, 760	84, 717, 194
1881	31, 829, 692	63, 819, 659	2, 372, 026	106, 004, 812
1882	17, 241, 767	47, 097, 207	4, 093, 029	69, 586, 466
1883	17, 999, 586	59, 652, 419	904, 519	81, 064, 373

Preserved meats.

Countries to which exported.	1879.	1880.	1881.	1882.	1883.
England	$5, 344, 791	$5, 632, 385	$4, 363, 237	$2, 702, 264	$3, 018, 439
Scotland	906, 260	961, 010	719, 356	750, 967	658, 994
British West Indies and Honduras	66, 949	76, 201	52, 413	35, 954	28, 026
Germany	402, 999	389, 823	291, 846	179, 681	139, 434
France	86, 976	150, 810	83, 091	14, 296	26, 606
Belgium	72, 381	74, 643	55, 633	68, 307	30, 594
Cuba	39, 239	17, 396	5, 903	11, 167	4, 579
Other countries	391, 813	574, 932	400, 078	445, 972	672, 230
Total	7, 311, 408	7, 877, 200	5, 971, 557	4, 208, 608	4, 578, 902

EXPORTS OF PORK PRODUCTS.

Years.	Bacon and hams.		Pork.		Lard.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Pounds.		*Pounds.*		*Pounds.*	
1873	395, 381, 737	$35, 022, 137	64, 147, 461	$5, 007, 035	230, 534, 207	$21, 245, 815
1874	347, 405, 405	33, 383, 908	70, 482, 379	5, 808, 712	205, 527, 471	19, 308, 019
1875	250, 286, 549	28, 612, 613	56, 152, 331	5, 671, 495	166, 869, 393	22, 900, 522
1876	327, 730, 172	39, 664, 456	54, 195, 118	5, 744, 022	168, 405, 839	22, 429, 485
1877	460, 057, 146	49, 512, 412	69, 671, 894	6, 296, 414	234, 741, 233	25, 562, 665
1878	592, 814, 351	51, 752, 068	71, 889, 255	4, 913, 657	342, 766, 254	30, 022, 133
1879	732, 249, 576	58, 074, 433	84, 401, 676	4, 807, 568	326, 658, 686	22, 856, 673
1880	759, 773, 109	50, 987, 623	95, 949, 780	5, 930, 252	374, 979, 286	27, 920, 367
1881	746, 944, 545	61, 161, 205	107, 928, 086	8, 272, 285	378, 142, 496	35, 226, 575
1882	468, 026, 640	46, 675, 774	80, 447, 466	7, 201, 270	250, 367, 740	28, 975, 902
1883	340, 258, 670	38, 155, 952	62, 116, 302	6, 192, 268	224, 718, 474	26, 618, 048

VALUE OF FARM ANIMALS.

The value of farm animals, as reported in the census of 1880, was $1,500,464,609. This includes only stock on farms, exclusive of ranch cattle, sheep, and horses, and stock in towns and villages. The prices have advanced since 1883. The value of stock, as estimated in January, 1883, was as follows:

Stock.	Number.	Average value.	Value.
Horses	10, 838, 111	$70 59	$765, 041, 308
Mules	1, 871, 079	79 49	148, 732, 390
Milch cows	13, 125, 685	30 21	396, 557, 405
Other cattle	28, 046, 077	21 80	611, 549, 109
Sheep	49, 237, 291	2 53	124, 365, 835
Swine	43, 270, 086	6 75	291, 951, 221

This makes a total value of $2,338,197,268. The numbers are intended to include all animals on farms, ranches, or public lands.

The increase in prices in four years from 1879, the time of lowest depression in twenty years, is very marked. According to the Department returns this advance amounts to 35 per cent. for horses, 41 for mules, 39 for milch cows, 41 for other cattle, 22 for sheep, and 112 for swine. Besides the general advance of values incident to a recovery of business prosperity, there is a powerful cause at work in the case of swine, the unexampled cheapness of corn in 1879, from consecutive crops of great abundance, and the high prices now prevailing in consequence of poor yields. This increase in values, applied to the census numbers, amounts to $2,174,000,000.

Average price of farm animals.

Years.	Horses.	Mules.	Cows.	Other cattle.	Sheep.	Swine.
1870	$81 38	$109 01	$39 12	$22 54	$2 28	$6 99
1871	78 51	101 52	37 33	22 81	2 32	6 19
1872	73 37	94 82	31 97	19 61	2 80	4 36
1873	74 21	95 15	29 72	20 06	2 96	4 09
1874	71 45	89 22	27 99	19 15	2 61	4 36
1875	68 01	80 00	28 52	18 68	2 79	5 34
1876	64 96	75 33	28 89	19 04	2 60	6 80
1877	60 08	68 91	27 32	17 10	2 27	6 09
1878	58 16	63 70	26 41	17 14	2 25	4 98
1879	52 41	56 06	21 73	15 39	2 07	3 18
1880	54 75	61 26	23 27	16 10	2 21	4 28
1881	58 44	69 79	23 95	17 33	2 39	4 70
1882	58 52	71 35	25 89	19 89	2 37	5 98
1883	70 59	79 49	30 21	21 80	2 53	6 75

The course of prices, as indicated in the foregoing table, is suggestive and instructive to a reader well versed in the recent history of our agriculture.

Horses became scarce and high during the war, declining afterwards very gradually as numbers increased and currency appreciated to par. Another cause of decline in values was the monetary depression, from which recovery commenced in 1879. Since that date there has been rapid appreciation of values, which has almost assumed the appearance of inflation during the past year.

Mules have a similar record, with a wider range in prices. They were relatively higher than horses in 1870. They at present average about 13 per cent. higher.

Cattle declined in value till 1879. Both general and special causes have since operated to stimulate prices. The general tendency to advance in all property has had its full effect; and the enlarged consumption of meat in this country, the live-cattle and fresh-meat export trade which has suddenly sprung into existence, the losses of cattle on the plains in the severe winter of 1880, and the reduced production of corn, which has succeeded six crops of great abundance, have combined to increase the average value of "stock" cattle from $15.39 to $21.80, an increase of 41 per cent. in four years. Cows were valued at extreme rates in 1870, and the reduction was rapid for three years, much slower from 1873 to 1877, and again accelerated in 1878 and 1879, when bottom was touched, and an era of advance inaugurated, which became a jump in 1882.

The tariff of 1867 has held sheep at more uniform valuations than ever before in the history of wool-growing, which had a prior history of unfortunate fluctuations, fatal to profit and to progress in breeding. This uniformity, which no other farm stock has shared, has resulted in a great increase in numbers, a larger fleece, improved mutton, and a nearly full supply for the country's consumption of wool, the establishment of a great manufacturing industry, and a marked enhancement of national re sources and the general welfare.

EMPLOYMENTS OF THE PEOPLE.

The people of the United States are industrious. There are few drones in the national hive. The census of 1880 enumerated the workers in all industries, including classes in agriculture, manufactures, mining, trade, transportation, and professional and personal service. The whole population, as reported, was 50,155,783. Those under ten years of age, numbering 13,394,176, were not included in the enumeration of workers. Nor were the women, the wives, widows, or daughters, engaged in household affairs, not receiving wages for service, although the cares and labors of a large proportion place them fairly in the position of workers. This omission, which is perhaps a necessary one, is exhibited in the disparity between numbers, respectively, of males and females in occupations, as reported. Of 17,392,099, a little more than a third of the total population, 14,744,942 are males and 2,647,157 are females. This of course fails to show the relative industry of the sexes, for the reason above stated.

Besides women in families, and children of ten years and under, there remain aged people who have retired from active labor, the sick, the mentally infirm, and the idlers who neither toil nor spin, though gorgeously arrayed at the expense of their ancestors or their tailors. But the

non-working class is not yet large, and the increase in national wealth is a resulting fact which is attracting the attention of the civilized world.

These workers are, first, 7,670,493 engaged in agriculture, 44.1 per cent. of all; 4,074,238 in professional and personal service.

Number and proportion of persons engaged in the several classes of occupations in the States and Territories of the United States, as deduced from the census of 1880.

States and Territories.	Number of persons in all occupations.	Number in agricultural occupations.		Number in professional and personal occupations.	
	Number.	*Number.*	*Per cent.*	*Number.*	*Per cent.*
Maine	231, 993	82, 130	35. 4	47, 411	20. 4
New Hampshire	142, 468	44, 490	31. 2	28, 206	19. 8
Vermont	118, 584	55, 251	46. 6	28, 174	23. 8
Massachusetts	720, 774	64, 973	9. 0	170, 160	23. 6
Rhode Island	116, 979	10, 945	9. 4	24, 657	21. 1
Connecticut	241, 333	44, 026	18. 2	51, 296	21. 3
New York	1, 884, 645	377, 460	20. 0	537, 897	28. 5
New Jersey	396, 879	59, 214	14. 9	110, 722	27. 9
Pennsylvania	1, 456, 067	301, 112	20. 7	446, 713	30. 7
Delaware	54, 580	17, 849	32. 7	17, 616	32. 3
Maryland	324, 432	90, 927	28. 0	98, 934	30. 5
Virginia	494, 240	254, 099	51. 4	146, 664	29. 7
North Carolina	480, 187	360, 937	75. 2	69, 821	14. 4
South Carolina	392, 102	294, 602	75. 1	64, 246	16. 4
Georgia	597, 862	432, 204	72. 3	104, 269	17. 4
Florida	91, 536	58, 731	64. 2	17, 923	19. 6
Alabama	492, 790	380, 630	77. 2	72, 211	14. 7
Mississippi	415, 506	339, 938	81. 8	49, 448	11. 9
Louisiana	363, 228	205, 306	56. 5	98, 111	27. 0
Texas	522, 133	359, 317	68. 8	97, 561	18. 7
Arkansas	260, 692	216, 655	83. 1	23, 466	9. 0
Tennessee	447, 970	294, 153	65. 7	94, 107	21. 0
West Virginia	176, 199	107, 578	61. 1	31, 680	18. 0
Kentucky	519, 854	320, 571	61. 7	104, 239	20. 0
Ohio	994, 475	397, 495	40. 0	250, 371	25. 2
Michigan	569, 204	240, 319	42. 2	143, 249	25. 2
Indiana	635, 080	331, 240	52. 2	137, 281	21. 6
Illinois	999, 780	436, 371	43. 7	229, 467	22. 9
Wisconsin	417, 455	195, 901	46. 9	97, 494	23. 4
Minnesota	255, 125	131, 535	51. 6	59, 452	23. 3
Iowa	528, 302	303, 557	57. 5	103, 932	19. 7
Missouri	692, 959	355, 297	51. 3	148, 588	21. 4
Kansas	322, 285	206, 080	63. 9	53, 507	16. 6
Nebraska	152, 614	90, 507	59. 3	28, 746	18. 8
California	376, 505	79, 396	21. 1	121, 435	32. 3
Oregon	67, 343	27, 091	40. 2	16, 645	24. 7
Nevada	32, 233	4, 180	13. 0	10, 373	32. 2
Colorado	101, 251	13, 539	13. 4	24, 813	24. 5
Arizona	22, 271	3, 435	15. 4	8, 210	36. 9
Dakota	57, 844	28, 508	49. 3	14, 016	24. 2
Idaho	15, 578	3, 858	24. 8	3, 861	24. 8
Montana	22, 255	4, 513	20. 3	6, 954	31. 3
New Mexico	40, 822	14, 139	34. 6	19, 042	46. 7
Utah	40, 055	14, 550	36. 3	11, 144	27. 8
Washington	30, 122	12, 781	42. 4	6, 640	22. 1
Wyoming	8, 884	1, 639	18. 4	4, 011	45. 2
District of Columbia	66, 624	1, 464	2. 2	39, 975	60. 0
United States	17, 392, 099	7, 670, 493	44. 1	4, 074, 238	23. 4

Number and proportion of persons engaged in the several classes of occupations in the States and Territories of the United States, as deduced from the census of 1880—Continued.

States and Territories.	Number in trade and transportation.		Number in manufactures and mechanical and mining industries.		Total population.
	Number.	*Per cent.*	*Number.*	*Per cent.*	
Maine	29,790	12.9	72.662	31.3	648,936
New Hampshire	11,735	8.3	58,037	40.7	346,991
Vermont	8,945	7.5	26,214	22.1	332,286
Massachusetts	115,376	16.0	370,265	51.4	1,783,085
Rhode Island	15,217	13.0	66,160	56.5	276,531
Connecticut	29,920	12.4	116,091	48.1	622,700
New York	339,419	18.0	629,869	33.5	5,082,871
New Jersey	66,382	16.7	160,561	40.5	1,131,116
Pennsylvania	179,965	12.3	528,277	36.3	4,282,891
Delaware	4,967	9.1	14,148	25.9	146,608
Maryland	49,234	15.2	85,337	26.3	934,943
Virginia	30,418	6.2	63,059	12.7	1,512,565
North Carolina	15,966	3.3	33,963	7.1	1,399,750
South Carolina	13,556	3.5	19,698	5.0	995,577
Georgia	25,222	4.2	36,167	6.1	1,542,180
Florida	6,446	7.0	8,436	9.2	269,493
Alabama	16,953	3.4	22,996	4.7	1,262,505
Mississippi	12,975	3.1	13,145	3.2	1,131,597
Louisiana	29,130	8.0	30,681	8.5	939,946
Texas	34,909	6.7	30,346	5.8	1,591,749
Arkansas	9,233	3.5	11,338	4.4	802,525
Tennessee	23,628	5.3	36,082	8.0	1,542,359
West Virginia	10,653	6.0	26,288	14.9	618,457
Kentucky	33,563	6.5	61,481	11.8	1,648,690
Ohio	104,315	10.4	242,294	24.4	3,198,062
Michigan	54,723	9.6	130,913	23.0	1,636,937
Indiana	56,432	8.9	110,127	17.3	1,978,301
Illinois	128,372	12.8	205,570	20.6	3,077,871
Wisconsin	37,550	9.0	86,510	20.7	1,315,497
Minnesota	24,349	9.5	39,789	15.6	780,773
Iowa	50,872	9.6	69,941	13.2	1,624,615
Missouri	79,300	11.5	109,774	15.8	2,168,380
Kansas	26,379	8.2	36,319	11.3	996,096
Nebraska	15,106	9.9	18,255	12.0	452,402
California	57,392	15.2	118,282	31.4	864,694
Oregon	6,149	9.2	17,458	25.9	174,768
Nevada	4,449	13.8	13,231	41.0	62,266
Colorado	15,491	15.3	47,408	46.8	194,327
Arizona	3,252	14.6	7,374	33.1	40,440
Dakota	6,219	10.8	9,101	15.7	135,177
Idaho	1,327	8.5	6,532	41.9	32,610
Montana	2,766	12.4	8,022	36.0	39,159
New Mexico	3,264	8.0	4,377	10.7	119,565
Utah	4,149	10.4	10,212	25.5	143,963
Washington	3,405	11.3	7,296	24.2	75,116
Wyoming	1,545	17.4	1,689	19.0	20,789
District of Columbia	9,848	14.8	15,337	23.0	177,624
United States	1,810,256	10.4	3,837,112	22.1	50,155,783

Number and proportion of farmers, agricultural laborers, and others employed in agriculture.

States and Territories.	Agricultural laborers.		Farmers.		Others in agriculture.		Total employed in agriculture.	
	Number.	*Pr. ct.*	*Number.*	*Pr. ct.*	*Number.*	*Pr. ct.*	*Number.*	*Pr. ct.*
Alabama	235,777	47.8	143,811	29.2	1,042	0.2	380,630	77.2
Arizona	596	2.7	1,725	7.7	1,114	5.0	3,435	15.4
Arkansas	107,479	41.2	108,775	41.7	401	0.2	216,655	83.1
California	23,856	6.3	43,489	11.6	12,051	3.2	79,396	21.1
Colorado	2,540	2.5	6,511	6.4	4,488	4.5	13,539	13.4
Connecticut	15,704	6.5	27,006	11.2	1,316	0.6	44,026	18.3
Dakota	5,306	9.2	22,740	39.3	462	0.8	28,508	49.3
Delaware	8,793	16.1	8,840	16.2	216	0.4	17,849	32.7
District of Columbia	410	0.7	333	0.5	721	1.1	1,464	2.3
Florida	32,259	35.2	25,505	27.9	967	1.1	58,731	64.2
Georgia	284,060	47.5	145,062	24.3	3,082	0.5	432,204	72.3
Idaho	593	3.8	2,491	16.0	774	5.0	3,858	24.8
Illinois	150,907	15.1	281,100	28.1	4,364	0.5	436,371	43.7

Number and proportion of farmers, agricultural laborers, &c.—Continued.

States and Territories.	Agricultural laborers.		Farmers.		Others in agriculture.		Total employed in agriculture.	
	Number.	*Pr. ct.*	*Number.*	*Pr. ct.*	*Number.*	*Pr. ct.*	*Number.*	*Pr. ct.*
Indiana	118, 807	18. 7	210, 279	33. 1	2, 154	0. 4	331, 240	52. 2
Iowa	88, 399	16. 8	211, 862	40. 1	3, 296	0. 6	303, 557	57. 5
Kansas	54, 902	17. 0	147, 614	45. 8	3, 564	1. 1	206, 080	63. 9
Kentucky	147, 247	28. 4	171, 625	33. 0	1, 699	0. 3	320, 571	61. 7
Louisiana	145, 735	40. 1	56, 598	15. 6	2, 973	0. 8	205, 306	56. 5
Maine	21, 868	9. 4	59, 884	25. 8	378	0. 2	82, 130	35. 4
Maryland	51, 236	15. 8	37, 754	11. 6	1, 937	0. 6	90, 927	28. 0
Massachusetts	22, 553	3. 15	39, 266	5. 5	3, 154	0. 4	64, 973	9. 0
Michigan	70, 845	12. 4	167, 141	29. 4	2, 333	0. 4	240, 319	42. 2
Minnesota	33, 993	13. 3	96, 648	37. 9	894	0. 4	131, 535	51. 6
Mississippi	215, 472	51. 8	123, 382	29. 7	1, 084	0. 3	339, 938	81. 8
Missouri	115, 325	16. 6	237, 107	34. 3	2, 865	0. 4	355, 297	51. 3
Montana	926	4. 2	2, 358	10. 6	1, 229	5. 5	4, 513	20. 3
Nebraska	19, 058	12. 5	68, 657	45. 0	2, 792	1. 8	90, 507	59. 3
Nevada	1, 188	3. 7	2, 032	6. 3	960	3. 0	4, 180	13. 0
New Hampshire	13, 893	9. 7	30, 371	21. 3	226	0. 2	44, 490	31. 2
New Jersey	22, 672	5. 7	33, 578	8. 5	2, 964	0. 7	59, 214	14. 9
New Mexico	4, 009	9. 8	6, 924	17. 0	3, 206	7. 8	14, 139	34. 6
New York	125, 685	6. 7	241, 507	12. 8	10, 268	0. 5	377, 460	20. 0
North Carolina	201, 774	42. 0	155, 985	32. 5	3, 178	0. 7	360, 937	75. 2
Ohio	131, 387	13. 2	261, 370	26. 3	4, 738	0. 5	397, 495	40. 0
Oregon	6, 598	9. 8	18, 374	27. 3	2, 119	3. 1	27, 091	40. 2
Pennsylvania	100, 381	6. 9	195, 370	13. 4	5, 361	0. 4	301, 112	20. 7
Rhode Island	3, 913	3. 4	6, 342	5. 4	690	0. 6	10, 945	9. 4
South Carolina	198, 147	50. 5	93, 550	23. 9	2, 905	0. 7	294, 602	75. 1
Tennessee	138, 185	30. 9	154, 192	34. 4	1, 776	0. 4	294, 153	65. 7
Texas	143, 812	27. 5	200, 404	38. 4	15, 101	2. 9	359, 317	68. 8
Utah	4, 137	10. 3	9, 130	22. 8	1, 283	3. 2	14, 550	36. 3
Vermont	19, 215	16. 2	35, 751	30. 2	285	0. 2	55, 251	46. 6
Virginia	132, 820	26. 9	119, 623	24. 2	1, 656	0. 3	254, 099	51. 4
Washington	3, 034	10. 1	9, 028	29. 9	719	2. 4	12, 781	42. 4
West Virginia	41, 767	23. 7	65, 497	37. 2	314	0. 2	107, 578	61. 1
Wisconsin	56, 170	13. 4	138, 443	33. 2	1, 288	0. 3	195, 901	46. 9
Wyoming	443	5. 0	911	10. 3	285	3. 2	1, 639	18. 5
United States	3, 323, 876	19. 1	4, 225, 945	24. 3	120, 672	0. 7	7, 670, 493	44. 1

Value of farm productions per capita of persons engaged in agriculture.

States and Territories.	Persons engaged in agriculture.	Estimated value of all farm productions (sold or consumed or on hand).	Per capita.	Persons engaged in all classes of occupation.	Persons engaged in agriculture.	Per cent.
Maine	82, 130	$21, 945, 489	$267 20	231, 993	82, 130	35
New Hampshire	44, 490	13, 474, 330	302 86	142, 468	44, 490	31
Vermont	55, 251	22, 082, 656	399 68	118, 584	55, 251	47
Massachusetts	64, 973	24, 160, 881	371 86	720, 774	64, 973	9
Rhode Island	10, 945	3, 670, 135	335 33	116, 979	10, 945	9
Connecticut	44, 026	18, 010, 075	409 08	241, 333	44, 026	18
New York	377, 460	178, 025, 695	471 64	1, 884, 645	377, 460	20
New Jersey	59, 214	29, 650, 756	500 74	396, 879	59, 214	15
Pennsylvania	301, 112	129, 760, 476	430 94	1, 456, 067	301, 112	21
Delaware	17, 849	6, 320, 345	354 10	54, 580	17, 849	33
Maryland	90, 927	28, 839, 281	317 17	324, 432	90, 927	28
Virginia	254, 099	45, 726, 221	179 95	494, 240	254, 099	51
North Carolina	360, 937	51, 729, 611	143 32	480, 187	360, 937	75
South Carolina	294, 602	41, 108, 112	139 54	392, 102	294, 602	75
Georgia	432, 204	67, 028, 929	155 09	597, 862	432, 204	72
Florida	58, 731	7, 439, 392	126 67	91, 536	58, 731	64
Alabama	380, 630	56, 872, 994	149 42	492, 790	380, 630	77
Mississippi	339, 938	63, 701, 844	187 39	415, 506	339, 938	82
Louisiana	205, 306	42, 883, 522	208 88	363, 228	205, 306	57
Texas	359, 317	65, 204, 329	181 47	522, 133	359, 317	69
Arkansas	216, 655	43, 796, 261	202 15	260, 692	216, 655	83
Tennessee	294, 153	62, 076, 311	211 03	447, 970	294, 153	66
West Virginia	107, 578	19, 360, 049	179 96	176, 199	107, 578	61
Kentucky	320, 571	63, 850, 155	199 18	519, 854	320, 571	62
Ohio	397, 495	156, 777, 152	394 41	994, 475	397, 495	40
Michigan	240, 319	91, 159, 858	379 33	569, 204	240, 319	42

Value of farm productions per capita of persons engaged in agriculture—**Continued.**

States and Territories.	Persons engaged in agriculture.	Estimated value of all farm productions (sold or consumed or on hand.)	Per capita.	Persons engaged in all classes of occupation.	Persons engaged in agriculture.	Per cent.
Indiana	331,240	$114,707,082	$346 30	635,080	331,240	52
Illinois	436,371	203,980,137	467 45	999,780	436,371	44
Wisconsin	195,901	72,779,496	371 51	417,455	195,901	47
Minnesota	131,535	49,468,951	376 09	255,125	131,535	52
Iowa	303,557	136,103,473	448 36	528,302	303,557	57
Missouri	355,297	95,912,660	269 95	692,959	355,297	51
Kansas	206,080	52,240,361	253 50	322,285	206,080	64
Nebraska	90,507	31,708,914	350 35	152,614	90,507	59
California	79,396	59,721,425	752 20	376,505	79,396	21
Oregon	27,091	13,234,548	488 52	67,343	27,091	40
Nevada	4,180	2,855,449	683 12	32,233	4,180	13
Colorado	13,539	5,035,228	371 91	101,251	13,539	13
Arizona	3,435	614,327	178 84	22,271	3,435	15
Dakota	28,508	5,648,814	198 15	57,844	28,508	49
Idaho	3,858	1,515,314	392 77	15,578	3,858	25
Montana	4,513	2,024,923	448 69	22,255	4,513	20
New Mexico	14,139	1,897,974	134 24	40,822	14,139	35
Utah	14,550	3,337,410	229 38	40,055	14,550	36
Washington	12,781	4,212,750	329 61	30,122	12,781	42
Wyoming	1,639	372,391	227 21	8,884	1,639	18
District of Columbia	1,464	514,441	351 39	66,624	1,464	2
Total	7,670,493	2,212,540,927	288 45	17,392,099	7,670,493	44

The changes that have occurred in the proportions of these great classes of occupations during ten years are seen as follows:

	In agriculture.	In manufactures, mining, &c.	In professional and personal service.	In trade and transportation.
Census of 1870	47.35	21.65	21.47	9.53
Census of 1880	44.1	23.4	22.1	10.4

There has been a decrease in the proportion of cultivators of the soil and increase in the manufacturing and mechanical class, a small increase in that of trade and transportation and in that of personal service. This is an indication of progress and prosperity.

In earlier times the agricultural class has been greatly in excess and other industries undeveloped. It is found that the best cultivation, the largest yields, and the best net results are not in districts exclusively agricultural. This decrease in the proportion in agriculture during ten years, from 47.35 to 44.1 per cent. of all workers, has not been attended with loss of farm area or farm production. On the contrary, there has been a large increase in the number of farms, in the area in cultivation, and also in production and exportation. With increasing numbers in other occupations prices have advanced, farm implements and machines have facilitated labor and enlarged its results.

The Eastern and Middle States have considerably reduced proportions of the agricultural clsss. The Southern Atlantic States show a smaller reduction, and the Gulf States very little. Missouri is substantially in *statu quo*, but the corn and wheat growing States of the West are less exclusively agricultural. The number of persons engaged in agriculture in 1880 was 7,670,493; in 1870, 5,922,471. The relative number of farm laborers has diminished, while the proportion of proprietors has increased. The number of laborers was 2,885,996 in 1870, 3,323,876 in 1880. The number of farmers was 2,977,711 in 1870, and 4,225,945 in 1880. It is a gratifying and promising fact that relative number of farm laborers are decreasing. Lands are yet abundant, and farms will increase by

subdivision, and it is for the highest good of the country that owners and tenant occupiers should outnumber laborers. The time will come when lands will be scarce and population enlarged and laborers in larger proportion. The proportion of females enumerated as engaged in agriculture is also increased. The number given as farmers is 56,809. A large proportion of the female farm laborers are colored women in the South.

The distribution by age and sex of each subclass in agriculture is as follows:

Occupation.	Persons occupied.	Ages and sex.			
		All ages.		10 to 15.	
		Males.	Females.	Males.	Females.
All occupations	17, 392, 099	14, 744, 942	2, 647, 157	825, 187	293, 169
Agriculture	7, 670, 493	7, 075, 983	594, 510	584, 867	135, 862
Agricultural laborers	3, 323, 876	2, 788, 976	534, 900	580, 576	135, 591
Apiarists	1, 016	999	17	3	
Dairymen and dairywomen	8, 948	8, 238	710	136	54
Farm and plantation overseers	3, 106	2, 913	193	1	
Farmers and planters	4, 225, 945	4, 169, 136	56, 809		
Florists	4, 550	4, 320	230	72	10
Gardeners, nurserymen, and vine-growers	51, 482	50, 173	1, 309	1, 036	155
Stock-drovers	3, 449	3, 449		110	
Stock-herders	24, 098	24, 004	94	2, 755	38
Stock-raisers	16, 528	16, 406	122		
Turpentine farmers and laborers	7, 450	7, 325	125	178	14
Others in agriculture	45	44	1		

Occupation.	Ages and sex.			
	16 to 59.		60 and over.	
	Males.	Females.	Males.	Females.
All occupations	12, 986, 111	2, 283, 115	933, 644	70, 873
Agriculture	5, 888, 133	435, 920	602, 983	22, 728
Agricultural laborers	2, 126, 811	386, 664	81, 589	12, 645
Apiarists	904	17	92	
Dairymen and dairywomen	7, 816	622	286	34
Farm and plantation overseers	2, 736	152	176	41
Farmers and planters	3, 657, 557	47, 042	511, 579	9, 767
Florists	4, 063	203	185	17
Gardeners, nurserymen, and vine-growers	41, 317	954	7, 820	200
Stock-drovers	3, 220		119	
Stock-herders	20, 717	52	532	4
Stock-raisers	15, 877	102	529	20
Turpentine farmers and laborers	7, 074	111	73	
Others in agriculture	41	1	3	

DISTRIBUTION BY AGES.

The following condensed statement shows that 34.7 per cent. of the whole number of people are classed as having occupations, numbering 17,392,099 persons. Seven-eighths of all are between the ages of 15 and 60. The proportion of the different ages are thus expressed:

Ages.	Number.	Per cent.
10 to 15 years	1, 118, 356	6. 4
16 to 59 years	15, 269, 226	87. 8
60 years and over	1, 004, 517	5. 8

The total number of persons engaged in agriculture, 7,670,493, are thus distributed by ages:

Ages.	Number.	Per cent.
10 to 15 years	720,729	9.4
16 to 59 years	6,324,053	82.5
60 years and over	625,711	8.1

Distributing the aggregate to show the proportions of farmers, laborers, &c., by ages, the following statement is made:

Ages.	Farmers.	Per cent.	Farm laborers.	Per cent.	Rural specialties.	Per cent.
10 to 15 years	......	......	716,167	9.3	4,562	0.1
16 to 59 years	3,704,599	48.3	2,513,475	32.8	105,979	1.4
60 years and over	521,346	6.8	94,234	1.2	10,131	0.1

DISTRIBUTION BY NATIVITY.

Four-fifths of the workers of the United States were born in this country. The other fifth is distributed between Germany, Ireland, Great Britain, Canada, and nearly all countries of the world in small proportions. The figures are as follows:

Nativity.	Workers in all occupations.	Per cent.
United States	13,897,452	79.9
Ireland	978,854	5.6
Germany	1,033,190	5.9
Great Britain	466,505	2.7
Scandinavia	205,525	1.2
British Provinces	351,103	2.0
Other countries	459,470	2.7

Taking separately the agricultural workers, we find that instead of about eight-tenths of native workers the proportion of native agriculturists is nine-tenths, very nearly. The foreign element in agriculture is comparatively small. As agriculturists represent nearly half the population, this difference is better shown by giving the actual numbers. The foreign born engaged in agriculture number 812,829; in other occupations, 2,681,818. In agriculture, 10.6 per cent.; in other occupations, 27.6 per cent. The relative numbers of all engaged in agriculture is as follows:

Nativity.	Workers in agriculture.	Per cent.
United States	6,857,664	89.4
Ireland	140,307	1.8
Germany	293,722	3.9
Great Britain	104,314	1.4
Scandinavia	91,836	1.2
British Provinces	73,435	1.0
Other countries	109,215	1.3

The Scandinavian immigrants, though not largest in number are largest in proportion, being 44.7 per cent. of all workers; the Germans have 28.4 per cent.; immigrants from England and Scotland, 22.4; from Canada, 20.9; and from Ireland, 14.3 per cent.

The distribution by classes is thus given:

Nativity.	Farmers.	Per cent.	Farm laborers.	Per cent.	Farm specialists.	Per cent.
United States	3, 615, 765	85. 6	3, 162, 474	95. 1	79, 425	65. 8
Ireland	107, 708	2. 5	24, 236	0. 7	8, 363	6. 9
Germany	233, 390	5. 5	48, 210	1. 5	12, 122	10. 0
Great Britain	82, 867	2. 0	15, 216	0. 5	6, 231	5. 2
Scandinavia	68, 431	1. 6	22, 624	0. 7	781	0. 7
British Provinces	50, 635	1. 2	21, 214	0. 6	1, 586	1. 3
Other countries	67, 149	1. 6	29, 902	0. 9	12, 164	10. 1

It is seen that foreigners do not come here with the idea of becoming peasants or remaining farm laborers, for nearly four-fifths of all are found in the class of farmers. The large proportion of native farm laborers is caused by their relative predominance in the Southern States, as may be seen by reference to previous tables.

The numbers, by nativities, for all the classes named in the census, are as follows:

Occupation.	Persons occupied.	Nativity.						
		United States.	Ireland.	Germany.	Great Britain.	Scandinavian.	British America.	Other countries.
All occupations	17, 392, 099	13, 897, 452	978, 854	1, 033, 190	466, 505	205, 525	351, 103	459, 470
Agriculture	7, 670, 493	6, 857, 664	140, 307	293, 722	104, 314	91, 836	73, 435	109, 215
Agricultural laborers	3, 323, 876	3, 162, 474	24, 236	48, 210	15, 216	22, 624	21, 214	29, 902
Apiarists	1, 016	891	10	37	42	2	28	6
Dairymen and dairywomen	8, 948	5, 053	575	1, 469	258	87	301	1, 205
Farm and plantation overseers	3, 106	2, 780	95	73	51	7	26	74
Farmers and planters	4, 225, 945	3, 615, 765	107, 708	233, 390	82, 867	68, 431	50, 635	67, 149
Florists	4, 550	2, 512	337	753	595	26	69	258
Gardeners, nurserymen, and vine-growers	51, 482	26, 887	6, 298	8, 588	3, 888	359	537	4, 925
Stock-drovers	3, 449	2, 923	149	150	71	7	67	82
Stock-herders	24, 098	18, 245	440	624	704	245	289	3, 551
Stock-raisers	16, 528	12, 662	453	424	620	48	268	2, 053
Turpentine farmers and laborers	7, 450	7, 430	5	4	1	....	....	10
Others in agriculture	45	42	1	....	1	....	1	....

RELATION OF AGRICULTURE TO OTHER INDUSTRIES.

While agriculture is a foundation interest, on which others are based, and by which others are supported, in the sense of furnishing the alimentation on which their labor is performed, it can only reach its highest estate in the midst of varied industries. The dignity of the farmer's position, his independence, his control of the means of comfortable living in a high degree, are constantly asserted, and acknowledged relatively rather than absolutely. If true, dignity should not be erected as a bar to progress, and independence become exclusiveness which shuts out all plebeian industries. If it becomes first an isolated aristocracy, it will soon be as poor as it is proud. The industries thrive together;

it is next to impossible to touch one without affecting the others. The solidarity of human industry is a fact that is proven in the industrial progress and development of every country.

Three hundred years ago Virginia stood as to-day in resources of nature, yet a beautiful desert, with only spontaneous crops growing upon her soil, deer and turkeys her only cattle, her waters simply a breeding place for fish, her lands without a market, her ores and coals lying worthless below the soil. Agriculture, manufactures, and commerce were practically unknown. Two hundred and sixty years of agriculture have failed to produce the prosperity that sixty would have brought with a suitable combination of all the industrial arts. Naturally, agriculture comes first, but other industries must follow, or rural arts will pine and struggle through a dwarfed existence. Virginia has heretofore held too exclusively to the idea of the dignity and independence of agriculture. She has hitherto sought wealth in the soil, but is now finding it in the coal mine, the iron ores, the dense forests, the enduring waterfall, and a thousand sources of production which are in their utilization rounding into symmetry and giving volume and momentum to the grand whole of Virginia industry.

Pennsylvania had a later and slower settlement. She has no seacoast, and is almost destitute of natural water-ways and great aqueous basins for food-fish supplies. But Pennsylvania acted wisely and promptly upon the true theory of industrial development, that it should be various and symmetrical, furnishing lucrative employment for male and female, old and young, in-doors and in the open air, unskilled and rough, as well as nicely adjusted to the peculiar tastes and finer aptitudes of the delicate and refined, who are suffering for something to do.

More than half of the people of Virginia are farmers; only one in five of the Pennsylvanians are engaged in agriculture. Does the greater number in the former State make a greater demand for land and a higher price by reason of the competition? No; the competition is between one farmer and another in the sale of produce for which there is no near market; and the cheapening of products also cheapens the acres on which they are grown. So, Virginia farm lands are valued at $10.89 per acre, while those of Pennsylvania command $49.30. So says the census of 1880. It also says that the average farm worker of Virginia produces crops worth $180, while the Pennsylvania agriculturist gets $431. Why is this? Because of the other four mouths seeking to be filled and competing for the supply. Besides, high prices are a stimulus to large production, and fertilizers are more abundant in a district full of towns and villages.

These are not isolated examples. We see similar causes producing like effects in other States and in other countries throughout the working world. It is the result of a natural law which may be formulated thus: VALUES IN AGRICULTURE ARE ENHANCED BY INCREASE OF NON-AGRICULTURAL POPULATION.

To test the value of this hypothesis let us divide the States and Territories of the United States into four classes, the first having less than 30 per cent. engaged in agriculture; second, those with 30 and less than 50 per cent.; third, those with 50 and less than 70 per cent., and fourth, those having 70 per cent. and over, being almost exclusively agricultural States.

VALUE OF LANDS.

Applying this test to the value of lands the following result is obtained:

Classes.	Number of States and Territories.	Acres.	Value.	Value per acre.	Per cent. of workers in agriculture.
First class	15	77, 250, 742	$2, 985, 641, 197	$38 65	18
Second class	13	112, 321, 257	3, 430, 915, 767	30 55	42
Third class	13	237, 873, 040	3, 218, 108, 970	13 53	58
Fourth class	6	108, 636, 796	562, 430, 842	5 18	77

As the proportion of agriculture to other workers diminishes, the value of land increases, but in a much higher ratio. In the almost exclusively agricultural States, eight acres are worth little more than one in the first class, consisting of States of the largest non-agricultural population. In the class which averages 42 per cent. in agriculture the land is of more than twice the value of farms in the class which averages 58 per cent. of the people in rural employments.

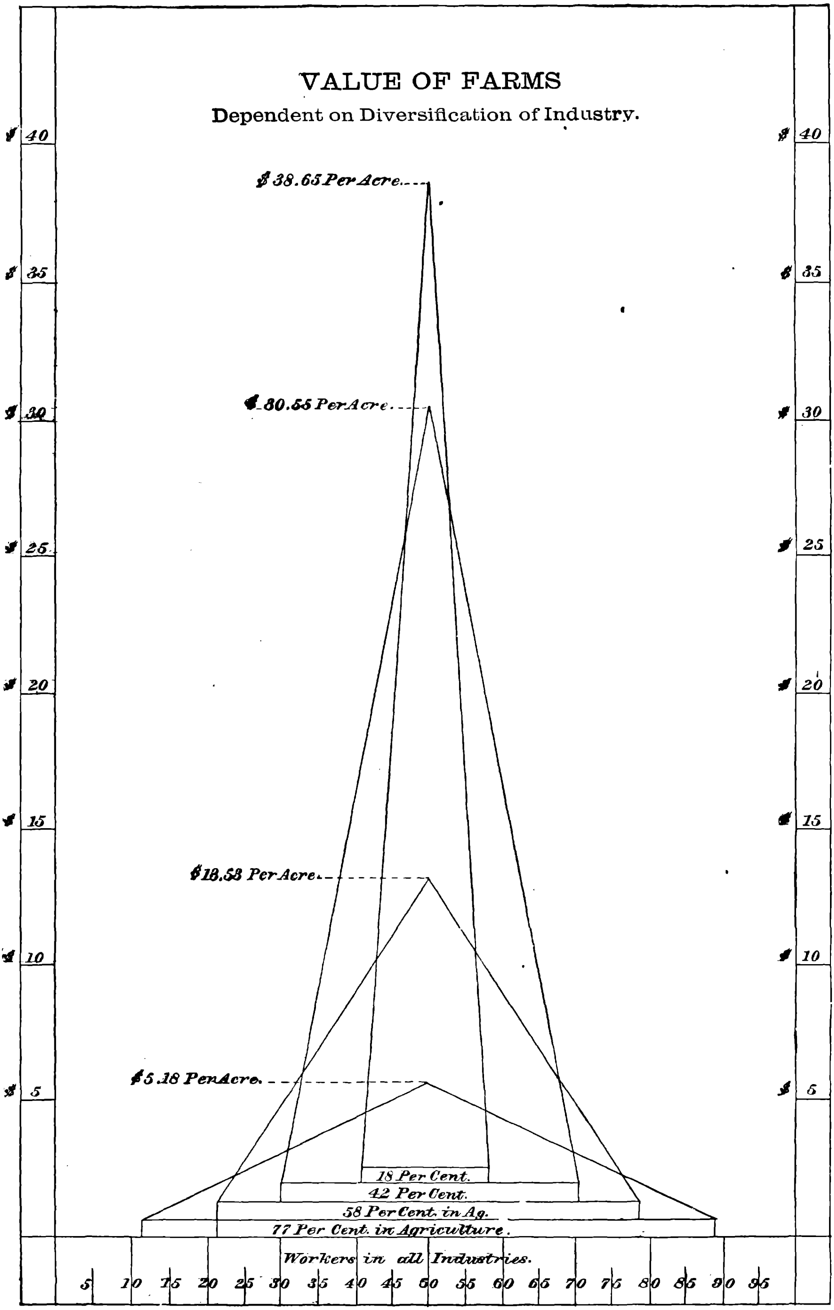
The following States and Territories all have less than 30 per cent. of their aggregate of persons in all occupations engaged in the pursuits of agriculture, and they average but 18 per cent.:

States and Territories.	Acres in farms.	Value of farms.	Value per acre.	Per cent. of workers in agriculture.
District of Columbia	18, 146	$3, 632, 403	$200 18	2
Massachusetts	3, 359, 079	146, 197, 415	43 52	9
Rhode Island	514, 813	25, 882, 079	50 27	9
Colorado	1, 165, 373	25, 109, 223	21 55	13
Nevada	530, 862	5, 408, 325	10 19	13
Arizona	135, 573	1, 127, 946	8 32	15
New Jersey	2, 929, 773	190, 895, 833	65 16	15
Wyoming	124, 433	835, 895	6 72	18
Connecticut	2, 453, 541	121, 063, 910	49 34	18
Montana	405, 683	3, 234, 504	7 97	20
New York	23, 780, 754	1, 056, 176, 741	44 41	20
Pennsylvania	19, 791, 341	975, 689, 410	49 30	21
California	16, 593, 742	262, 051, 282	15 79	21
Idaho	327, 798	2, 832, 890	8 64	25
Maryland	5, 119, 831	165, 503, 341	32 33	28
Total	77, 250, 742	2, 985, 641, 197	38 65	18

In this list the most diverse conditions are represented. On one extreme the District of Columbia has but 18,146 acres of agricultural land, which is valued at $200 per acre as suburban property under the shadow of a large city. On the other, small areas in the Territories are surrounded by immense bodies of unoccupied lands, which are given away by the United States Government, keeping the prices of cultivated farms low, though they are rising with great rapidity. California and Colorado are similarly situated, yet further advanced in point of time and in development of industries, and of course showing higher prices. In the States in which there is no public land to depress prices, there is no average that is not higher than the general average of the next class of States having 30 to 50 per cent. in agriculture; the range of prices is from $32.33 per acre in Maryland to $65.16 in New Jersey. Though New Jersey has 15 per cent. in agriculture, the influence of the adjacent populations of Philadelphia, New York, and Brooklyn reduces practically her percentage to a lower proportion than Massachusetts and Rhode Island.

The second class includes the smaller manufacturing States of the

E.—*Diagram showing value of farm lands as affected by increase of non-agricultural population.*



East and the older States of the West, in which the agricultural population is less than half of all.

States and Territories.	Acres in farms.	Value of farms.	Value per acre.	Per cent. of workers in agriculture.
New Hampshire	3, 721, 173	$75, 834, 389	$20 38	31
Delaware	1, 090, 245	36, 789, 672	33 74	33
New Mexico	631, 131	5, 514, 399	8 74	35
Maine	6, 552, 578	102, 357, 615	15 62	35
Utah	655, 524	14, 015, 178	21 38	36
Ohio	24, 529, 226	1, 127, 497, 353	45 97	40
Oregon	4, 214, 712	56, 908, 575	13 50	40
Washington	1, 409, 421	13, 844, 224	9 82	42
Michigan	13, 807, 240	499, 103, 181	36 15	42
Illinois	31, 673, 645	1, 009, 594, 580	31 87	44
Wisconsin	15, 353, 118	357, 709, 507	23 30	47
Vermont	4, 882, 588	109, 346, 010	22 40	47
Dakota	3, 800, 656	22, 401, 084	5 89	49
Total	112, 321, 257	3, 430, 915, 767	30 55	42

This list embraces also a few of the Territories, and a State or two in which the unoccupied public lands continue to depress prices of farm lands.

It is conceded that differing degrees of fertility must affect prices, and other causes may be operative; yet such is the controlling force of preponderating non-agricultural population in raising prices that we find the average of this class to be more than twenty-five per cent. lower than class first.

When the proportion of farmers is increased to half or two-thirds the price of land declines seriously, as follows:

States.	Acres in farms.	Value of farms.	Value per acre.	Per cent. of workers in agriculture.
Virginia	19, 835, 785	$216, 028, 107	$10 89	51
Missouri	27, 879, 276	375, 633, 307	13 47	51
Minnesota	13, 403, 019	193, 724, 260	14 45	52
Indiana	20, 420, 983	635, 236, 111	31 11	52
Louisiana	8, 273, 506	58, 989, 117	7 13	57
Iowa	24, 752, 700	567, 430, 227	22 92	57
Nebraska	9, 944, 826	105, 932, 541	10 65	59
West Virginia	10, 193, 779	133, 147, 175	13 06	61
Kentucky	21, 495, 240	299, 298, 631	13 92	62
Florida	3, 297, 324	20, 291, 835	6 15	64
Kansas	21, 417, 468	235, 178, 936	10 98	64
Tennessee	20, 666, 915	206, 749, 837	10 00	66
Texas	36, 292, 219	170, 468, 886	4 70	69
Total	237, 873, 040	3, 218, 108, 970	13 53	58

The States having over seventy per cent. engaged in agriculture are as follows:

States.	Acres in farms.	Value of farms.	Value per acre.	Per cent. of workers in agriculture.
Georgia	26, 043, 282	$111, 910, 540	$4 30	72
North Carolina	22, 363, 558	135, 793, 602	6 07	75
South Carolina	13, 457, 613	68, 677, 482	5 10	75
Alabama	18, 855, 334	78, 954, 648	4 19	77
Mississippi	15, 855, 462	92, 844, 915	5 86	82
Arkansas	12, 061, 547	74, 249, 655	6 16	83
Total	108, 636, 796	562, 430, 842	5 18	77

INCOME OF THE FARMER.

The owner of land finds a great advantage in the increase of the proportion of non-agricultural population. Does the cultivator of the soil obtain an annual product of higher value? The answer is an emphatic affirmative in the following statement from the census of 1880:

Classes.	Number engaged in agriculture.	Value of products of agriculture.	Value per capita.	Proportion of workers in agriculture.
				Per cent.
First class	1, 060, 681	$484, 770, 797	$457	18
Second class	1, 566, 875	616, 850, 959	394	42
Third class	3, 017, 971	786, 681, 420	261	58
Fourth class	2, 024, 966	324, 237, 751	160	77

There are nearly twice as many agricultural producers in the fourth class as are found in the first, yet the crops of the million are worth much more money than all the results of labor of the two million workers. The class that has 58 per cent. in agriculture makes $101 per annum more than that which has 77 per cent., and the class with the lower average of 42 per cent. gets $133 above the earnings of that which averages 58 per cent. in agriculture.

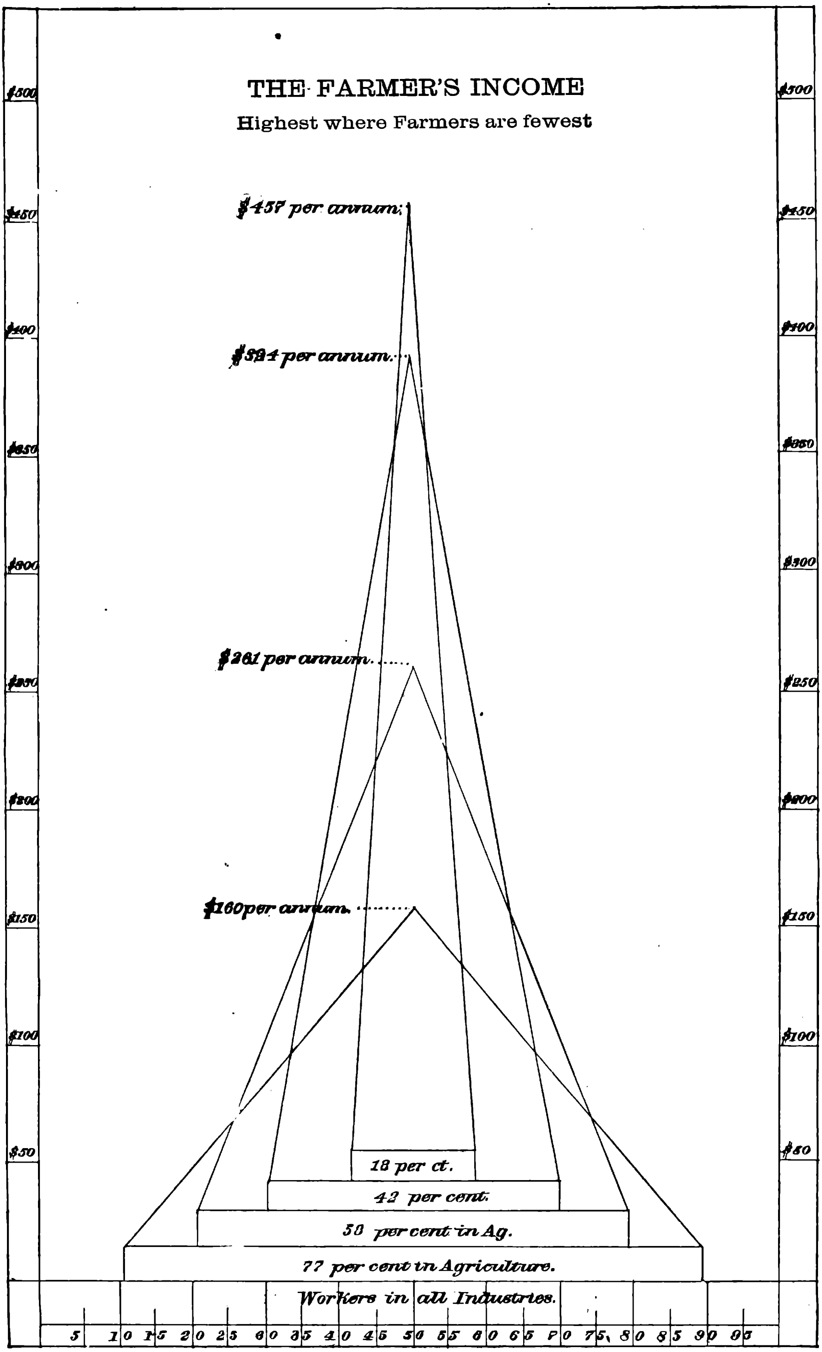
It is not assumed that there are no other causes affecting the quantity and value of the farmer's crops, which cause variations in the exhibit of individual States, but the relative proportions of agricultural and non-agricultural population constitute a factor which dominates all other factors, so that when such data are co-ordinated in classes of States the result appears with the invariability of the operation of law. That all these variations may be seen, and their causes sought by the rural economist, the following details are given:

States and Territories.	Persons in all occupations.	Persons engaged in agriculture.	Per cent. in agriculture.	Value of products of agriculture.	Value per capita.
District of Columbia	66, 624	1, 464	2	$514, 441	$351
Massachusetts	720, 774	64, 973	9	24, 160, 881	372
Rhode Island	116, 979	10, 945	9	3, 670, 135	335
Colorado	101, 251	13, 539	13	5, 035, 228	372
Nevada	32, 233	4, 180	13	2, 855, 449	683
Arizona	22, 271	3, 435	15	614, 327	179
New Jersey	396, 879	59, 214	15	29, 650, 756	501
Wyoming	8, 884	1, 639	18	372, 391	227
Connecticut	241, 333	44, 026	18	18, 010, 075	409
Montana	22, 255	4, 513	20	2, 024, 923	449
New York	1, 884, 645	377, 460	20	178, 025, 695	472
Pennsylvania	1, 456, 067	301, 112	21	129, 760, 476	431
California	376, 505	79, 396	21	59, 721, 425	752
Idaho	15, 578	3, 858	25	1, 515, 314	393
Maryland	324, 432	90, 927	28	28, 839, 281	317
Total	5, 786, 710	1, 060, 681	18	484, 770, 797	457

The largest income is enjoyed by the farmer of California, not only because 79 per cent. of the people of that State are outside of agriculture, making a market for his crops, but because of the demand throughout the United States for fruits, wines, and other peculiar products of that favored State. Wool is also a productive source of income, due to the market made by the woolen mills of other States.

Only in Oregon and Illinois, in the second class, are rural incomes up to the average of the first class, and only in New Mexico and Dakota

F.—*Diagram showing the value of farm products as affected by increase of non-agricultural population.*



are the annual earnings down to the average of the third class, so uniform is the action of this principle of industrial economy.

States and Territories.	Persons in all occupations.	Persons engaged in agriculture.	Per cent. in agriculture.	Value of products of agriculture.	Value per capita.
New Hampshire	142, 468	44, 490	31	$13, 474, 330	$303
Delaware	54, 580	17, 849	33	6, 320, 345	354
New Mexico	40, 822	14, 139	35	1, 897, 974	134
Maine	231, 993	82, 130	35	21, 945, 489	267
Utah	40, 055	14, 550	36	3, 337, 410	229
Ohio	994, 475	397, 495	40	156, 777, 152	394
Oregon	67, 343	27, 091	40	13, 234, 548	489
Washington	30, 122	12, 781	42	4, 212, 750	330
Michigan	569, 204	240, 319	42	91, 159, 858	379
Illinois	999, 780	436, 371	44	203, 980, 137	467
Wisconsin	417, 455	195, 901	47	72, 779, 496	372
Vermont	118, 584	55, 251	47	22, 082, 656	400
Dakota	57, 844	28, 508	49	5, 648, 814	198
Total	3, 764, 725	1, 566, 875	42	616, 850, 959	394

In the following list Iowa, Minnesota, and Nebraska lead in average income. They have below 60 per cent. in agriculture, have rich lands, easily cultivated, and send a large proportion of their products to eastern and foreign markets, and therefore have less of the stagnation of isolation.

States.	Persons in all occupations.	Persons engaged in agriculture.	Per cent. in agriculture.	Value of products of agriculture.	Value per capita.
Virginia	494, 240	254, 099	51	$45, 726, 221	$180
Missouri	692, 959	355, 297	51	95, 912, 660	270
Minnesota	255, 125	131, 535	52	49, 468, 951	376
Indiana	635, 080	331, 240	52	114, 707, 082	346
Louisiana	363, 228	205, 306	57	42, 883, 522	209
Iowa	528, 302	303, 557	57	136, 103, 473	448
Nebraska	152, 614	90, 507	59	31, 708, 914	350
West Virginia	176, 199	107, 578	61	19, 360, 049	180
Kentucky	519, 854	320, 571	62	63, 850, 155	199
Florida	91, 536	58, 731	64	7, 439, 392	126
Kansas	322, 285	206, 080	64	52, 240, 361	253
Tennessee	447, 970	294, 153	66	62, 076, 311	211
Texas	522, 133	359, 317	69	65, 204, 329	181
Total	5, 201, 525	3, 017, 971	58	786, 681, 420	261

In the almost exclusively agricultural States, the range of income per man is quite uniform, from $140 in South Carolina to $202 in Arkansas, the average of all being $160. It may be claimed that labor, from climatic or race considerations, is less efficient than in other States, but it is evident from the small areas planted, except in cotton and corn, and the small products gathered, that the lack of diversity in industry, and even of variety in agriculture, is dwarfing the magnificent productive resources of this great belt of States. The wisest and brighest of these farmers have reiterated this sentiment for a generation, and many are acting on it; but the reflex influence of manufactures and mining would accomplish more for agriculture than the most persistent direct efforts for the improvement of agriculture.

States.	Persons in all occupations.	Persons engaged in agriculture.	Per cent. in agriculture.	Value of products of agriculture.	Value per capita.
Georgia	597, 862	432, 204	72	$67, 028, 929	$155
North Carolina	480, 187	360, 937	75	51, 729, 611	143
South Carolina	392, 102	294, 602	75	41, 108, 112	140
Alabama	492, 790	380, 630	77	56, 872, 994	149
Mississippi	415, 506	339, 938	82	63, 701, 344	187
Arkansas	260, 692	216, 655	83	43, 796, 261	202
Total	2, 639, 139	2, 024, 966	77	324, 237, 751	160

WAGES OF LABOR.

Having shown that the value of the farm and the income of the farmer are enlarged by increasing the proportion of non-agricultural labors in a State, it is important to inquire whether the farm laborer shares in the advantage to the owner and cultivator of the soil. Fortunately a definite answer can be given from repeated and trustworthy returns of the wages of farm labor to the Department of Agriculture.

In 1870, when wages and prices generally were high, the average wages of farm labor in the first or manufacturing class of States was $34, while in the last, exclusively agricultural, class it was but $15. When the panic came, and years of manufacturing depression followed, mechanics and artisans competed with farm laborers and reduced the price of rural labor. It is a fact that prices at different times furnish an accurate measure both of the industrial status of the laborers and the prosperity of the great industries of the country.

In 1882 the wages of agricultural labor averaged nearly $25 in the first and second class, $19.50 in the third, and $13.20 in the fourth. The demand for wheat and corn, beef and pork, the product of Ohio, Michigan, Illinois, Wisconsin, and other States of the second class, to supply home, eastern, and foreign markets, brought up the value of farm labor to an equality with wages in the States of the first class. The scarcity of laborers, who prefer farms of their own, also contributed to high rates in this class. Where more than half of the workers are farmers, the competition of laborers reduces inevitably the rate of wages. So we find that where the proportion reaches three-fourths, the reduction usually amounts to 50 per cent.

The influence of manufactures, of mining, of any productive industries on local prices, whether of farms, or farm products, or farm labor, is plainly traceable in States, and in various districts within the States, by the furnace fires, the mines, the factories that thickly dot the location where high prices for farm labor prevail.

Diagrams E and F illustrate in a striking manner the operation of what may be deemed a law in industrial economy, and show that the value of farm lands depends more upon the diversification of industry than upon the fertility of the soil, and that the farmer's income is highest where farmers are fewest.

OUR WHEAT EXPORTS.

The wheat exports of fifty-eight years represent in volume a mountain of grain equal to 2,064,755,783 bushels, and a value 50 per cent. greater than the present amount of the national debt, or $2,594,292,442. Formerly wheat went abroad in the form of flour; recently the exports of grain have been immense, so that more than six-tenths of all these exports have been in unmanufactured grain.

More than half of this exportation has been made since 1874, or in nine years. The early movement in exportation was slow. In the thirty years from 1826 to 1855, inclusive, which is more than half of the period, the average exports of wheat (in the form of wheat and flour) were nearly nine million bushels per annum. In the next fifteen years the annual shipments had risen to thirty-three million bushels. Up to this time the volume had been slowly gathering momentum for a far more wonderful advance. For the next five, sixty millions; for the second five, more than a hundred millions per annum; for the

G.—*Diagram showin*

QUANTIT

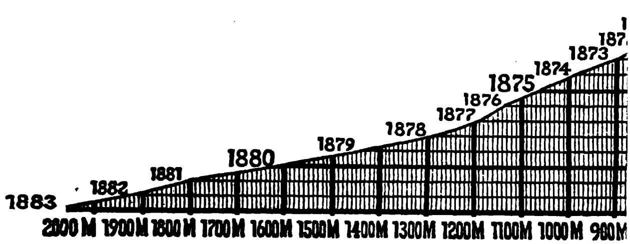
BUSHELS

Scale:

1/4 th inch to 100 millions.

WHEAT ......

FLOUR ......



thirteen years to June, 1883, eighty-four million bushels. The largest annual export, in 1880, was 186,321,514 bushels.

Diagram G shows the quantity and value of this exportation. The quantity can be measured on the horizontal lines on the left of the center for each period of five years, in bars of one hundred millions each, which are subdivided into tens of millions of bushels. A glance will suffice to show the total volume from 1825 to any given date on the diagram. The value is shown by the same horizontal lines on the right of the center, likewise measured in tens and hundreds of millions. The figure explains itself. By the remarkable curvature of the outer line, describing a concave figure, the excessive increase of recent years is shown. By this latest extension the breadth of the figure has been doubled in nine years.

Quantity of exports of wheat and flour.

Years.	Wheat.		Flour.		Total wheat and flour.	
	Bushels.	Bushels.	Bushels.	Bushels.	Bushels.	Bushels.
1830	125, 547		23, 259, 700		23, 385, 247	
1835	614, 145		26, 209, 820		26, 823, 965	
		739, 692		49, 469, 520		50, 209, 212
	739, 692		49, 469, 520		50, 209, 212	
1840	1, 842, 841		20, 464, 660		22, 307, 501	
		2, 582, 533		69, 934, 180		72, 516, 713
	2, 582, 533		69, 934, 180		72, 516, 713	
1845	2, 946, 861		31, 373, 485		34, 320, 346	
		5, 529, 394		101, 307, 665		106, 837, 059
	5, 529, 394		101, 307, 665		106, 837, 059	
1850	10, 184, 645		61, 424, 140		71, 608, 785	
		15, 714, 039		162, 731, 805		178, 445, 844
	15, 714, 039		162, 731, 805		178, 445, 844	
1855	16. 446, 955		65, 747, 590		82, 194, 545	
		32, 160, 994		228, 479, 395		260, 640, 389
	32, 160, 994		228, 479,395		260, 640, 389	
1860	38, 808, 573		78, 891, 340		117, 699, 913	
		70, 969, 567		307, 370, 735		378, 340, 302
	70, 969, 567		307, 370, 735		378, 340, 302	
1865	138, 306, 907		98, 788, 665		237, 095, 572	
		209, 276, 474		406, 159, 400		615, 435, 874
	209, 276,474		406, 159, 400		615, 435, 874	
1870	81, 808, 364		57, 273, 925		139, 082, 289	
		291, 084, 838		463, 433, 325		754, 518, 163
	291, 084, 838		463, 433, 325		754, 518, 163	
1875	224, 019, 374		83, 878, 210		307, 897, 584	
		515, 104, 212		547, 311, 535		1, 062, 415, 747
	515, 104, 212		547, 311, 535		1, 062, 415, 747	
1876	55, 073, 122		17, 709, 804		72, 782, 926	
		570, 177, 334		565, 021, 339		1, 135, 198, 673
	570, 177, 334		565, 021, 339		1, 135, 198. 673	
1877	40, 325, 611		15, 046, 492		55, 372, 103	
		610, 502, 945		580, 067, 831		1, 190, 570, 776
	610, 502, 945		580, 067, 831		1, 190, 570, 776	
1878	72, 404, 961		17, 762, 998		90, 167, 959	
		682, 907, 906		597, 830, 829		1, 280, 738, 735
	682, 907, 906		597, 830, 829		1, 280, 738, 735	
1579	122, 353, 936		25, 333, 713		147, 687, 649	
		805, 261, 842		623, 164, 542		1, 428, 426, 384
	805, 261, 842		623, 164, 542		1, 428, 426, 384	
1880	153, 252, 795		27, 051, 385		180, 304, 180	
		958, 514, 637		650, 215, 927		1, 608, 730, 564
	958, 514, 637		650, 215, 927		1, 608, 730, 564	
1881	150, 565, 477		35, 756, 037		186, 321, 514	
		1, 109, 080, 114		685, 971, 964		1, 795, 052, 078
	1, 109, 080, 114		685, 971, 964		1, 795, 052, 078	
1882	95, 271, 802		26, 620, 587		121, 892, 389	
		1, 204, 351, 916		712, 592, 551		1, 916, 944, 467
	1, 204, 351, 916		712, 592, 551		1, 916, 944, 467	
1883	106, 385, 828		41, 425, 488		147, 811, 316	
		1, 310, 737, 744		754, 018, 039		2, 064, 755, 783
Total	1, 310, 737, 744	....	754, 018, 039	....	2, 064, 755, 783	

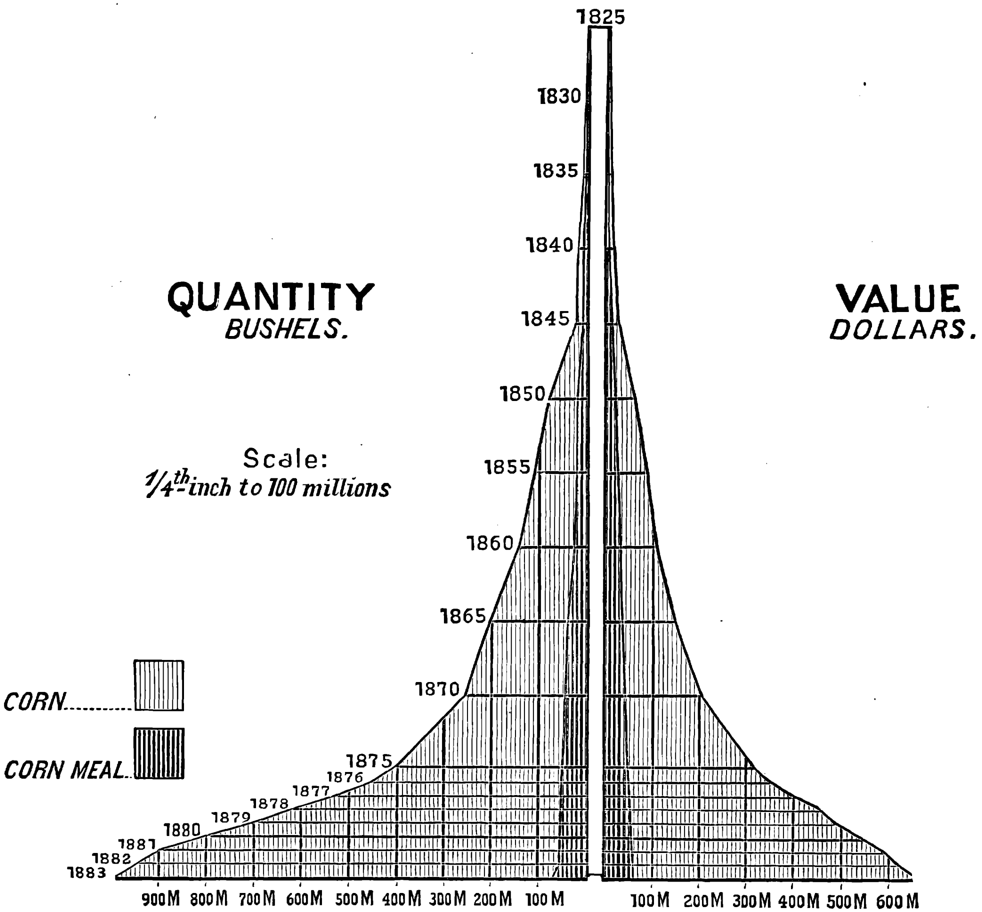
Value of exports of wheat and flour.

Years.	Wheat.		Flour.		Total value of wheat and flour.
	Value.	Value.	Value.	Value.	
1830	$112,754	....	$24,708,090	....	$24,820,844
1835	737,365		29,347,649		
		$850,119		$54,055,739	54,905,858
	850,119		54,055,739		
1840	1,817,067		27,231,952		
		2,667,186		81,287,691	83,954,877
	2,667,186		81,287,691		
1845	2,900,785		31,056,156		
		5,567,971		112,343,847	117,911,818
	5,567,971		112,343,847		
1850	12,801,093		69,375,741		
		18,369,064		181,719,588	200,088,652
	18,369,064		181,719,588		
1855	21,864,762		75,775,220		
		40,233,826		257,494,808	297,728,634
	40,233,826		257,494,808		
1860	53,343,918		104,368,446		
		93,577,744		361,863,254	455,440,998
	93,577,744		361,863,254		
1865	178,470,444		133,356,875		
		272,048,188		495,220,129	767,268,317
	272,048,188		495,220,129		
1870	117,527,424		92,071,717		
		389,575,612		587,291,846	976,867,458
	389,575,612		587,291,846		
1875	296,540,060		114,398,700		
		686,115,672		701,690,546	1,387,806,218
	686,115,672		701,690,546		
1876	68,382,899		24,433,470		
		754,498,571		726,124,016	1,480,622,587
	754,498,571		726,124,016		
1877	47,135,562		21,663,947		
		801,634,133		747,787,963	1,549,422,096
	801,634,133		747,787,963		
1878	96,872,016		25,095,721		
		898,506,149		772,883,684	1,671,389,833
	898,506,149		772,883,684		
1879	130,701,079		29,567,713		
		1,029,207,228		802,451,397	1,831,658,625
	1,029,207,228		802,451,397		
1880	190,546,305		35,333,197		
		1,219,753,533		837,784,594	2,057,538,127
	1,219,753,533		837,784,594		
1881	167,698,485		45,047,257		
		1,387,452,018		882,831,851	2,270,283,869
	1,387,452,018		882,831,851		
1882	112,929,[illegible]8		36,375,055		
		1,500,381,736		919,206,906	2,419,588,642
	1,500,381,736		919,206,906		
1883	119,879,341		54,824,459		
		1,620,261,077		974,031,365	2,594,292,442
Total	1,620,261,077	....	974,031,365		

EXPORTS OF CORN.

The shipment of maize as grain and in the form of meal, the whole expressed in bushels of shelled corn, are given for a period of fifty-eight years. There were small quantities exported before, even in the early days of the settlement of the country, scarcely noticeable up to 1845. In forty years, up to 1855, the average shipments were about 2,700,000 bushels per annum. Between 1865 and 1875 the shipments were greater than for the forty years preceding; and since 1875 the volume of exports has been far greater than for the fifty years prior to that date. The largest shipments were in 1880, within a fraction of 100,000,000 bushels. The exports of the six years of plenty, from the crops of 1875 to 1880, were 492,000,000 bushels in round numbers, an average of 82,000,000 bushels per annum. The export value of the shipments of this period was 56 cents per bushel. The records of shipments from the crops of 1881 and 1882 show the effect of reduced yield

H.—*Diagram showing quantity and value of corn exported in 58 years, meal included as corn.*



upon exportation. With a larger acreage than ever before, the exports averaged but 43,000,000 per year. It was not because it could not be spared, for our farmers have abundance of hay, stover, and straw as substitutes for at least a portion of the corn fed. It was principally the advanced price, consequent upon the home demand, that prevented the usual movement of corn to foreign countries. The average price of exported corn for these two years was 68 cents per bushel. The quantity was reduced almost one-half by an increase of 12 cents per bushel in the price. The use of American corn in Europe depends almost entirely upon the relative value of other feeding material for which maize comes in as a substitute.

Diagram H presents a graphic illustration of the course of corn exportation similar to that for wheat. As it is on the same scale as to quantity and value, the breadth of the figure will show the relative quantity and value. On the right especially the difference in the aggregate and bushel values is finely shown.

Quantity of exports of corn and corn-meal.

Years.	Corn.		Corn-meal.		Total bushels.
	Bushels.	Bushels.	Bushels.	Bushels.	
1830	3, 530, 710	....	3, 133, 632	....	6, 664, 342
1835	2, 568, 946		3, 269, 532		
		6, 099, 656		6, 403, 164	12, 502, 820
	6, 099, 656		6, 403, 164		
1840	1, 184, 973		3, 375, 720		
		7, 284, 629		9, 778, 884	17, 063, 513
	7, 284, 629		9, 778, 884		
1845	3, 474, 109		4, 530, 996		
		10, 758, 738		14, 309, 880	25, 068, 618
	10, 758, 738		14, 309, 880		
1850	43, 822, 153		9, 974, 800		
		54, 580, 891		24, 284, 680	78, 865, 571
	54, 580, 891		24, 284, 680		
1855	23, 905, 196		4, 485, 824		
		78, 486, 087		28, 770, 504	107, 256, 591
	78, 486, 087		28, 770, 504		
1860	27, 597, 896		5, 165, 368		
		106, 083, 983		33, 935, 872	140, 019, 855
	106, 083, 983		33, 935, 872		
1865	52, 612, 028		4, 706, 428		
		158, 696, 011		38, 642, 300	197, 338, 311
	158, 696, 011		38, 642, 300		
1870	47, 993, 276		5, 420, 096		
		206, 689, 287		44, 062, 396	250, 751, 683
	206, 689, 287		44, 062, 396		
1875	146, 152, 915		6, 416, 212		
		352, 842, 202		50, 478, 608	403, 320, 810
	352, 842, 202		50, 478, 608		
1876	49, 493, 572		1, 416, 960		
		402, 335, 774		51, 895, 568	454, 231, 342
	402, 335, 774		51, 895, 568		
1877	70, 860, 983		1, 791, 628		
		473, 196, 757		53, 687, 196	526, 883, 953
	473, 196, 757		53, 687, 196		
1878	85, 461, 098		1, 731, 012		
		558, 657, 855		55, 418, 208	614, 076, 063
	558, 657, 855		55, 418, 208		
1879	86, 296, 252		1, 588, 640		
		644, 954, 107		57, 006, 848	701, 960, 955
	644, 954, 107		57, 006, 848		
1880	98, 169, 877		1, 402, 452		
		743, 123, 984		58, 409, 300	801, 533, 284
	743, 123, 984		58, 409, 300		
1881	91, 908, 175		1, 739, 972		
		835, 032, 159		60, 149, 272	895, 181, 431
	835, 032, 159		60, 149, 272		
1882	43, 184, 915		1, 155, 768		
		878, 217, 074		61, 305, 040	939, 522, 114
	878, 217, 074		61, 305, 040		
1883	40, 586, 825		1, 068, 828		
		918, 803, 899		62, 373, 868	981, 177, 767
Total	918, 803, 899	....	62, 373, 868		

Value of exports of corn and corn-meal.

Years.	Corn.		Corn-meal.		Total value of corn and corn-meal.	
	Value.	Value.	Value.	Value.		
1830	$2, 019, 926		$2, 404, 371		$4, 424, 297	
1835	1, 804, 711		2, 731, 077		4, 535, 786	
		$3, 824, 637		$5, 135, 448		$8, 960, 085
	3, 824, 637		5, 135, 448		8, 960, 085	
1840	873, 104		3, 471, 215		4, 344, 319	
		4, 697, 741		8, 606, 663		13, 304, 404
	4, 697, 741		8, 606, 663		13 304, 404	
1845	1, 755, 602		3, 037, 021		4, 792, 623	
		6, 453, 343		11, 643, 684		18, 097, 027
	6, 453, 343		11, 643, 684		18, 097, 027	
1850	31, 277, 920		8, 984, 252		40, 262, 172	
		37, 731, 263		20, 627, 936		58, 359, 199
	37, 731, 263		20, 627, 936		58, 359, 190	
1855	17, 712, 699		4, 147, 318		21, 860, 017	
		55, 443, 962		24, 775, 254		80, 219, 216
	55, 443, 962		24, 775, 254		80, 219, 216	
1860	19, 789, 181		4, 917, 515		24, 706, 696	
		75, 233, 143		29, 692, 769		104, 925, 912
	75, 233, 143		29, 692, 769		104, 925, 912	
1865	34, 903, 365		5, 323, 270		40, 226, 635	
		110, 136, 508		35, 016, 039		145, 152, 547
	110, 136, 508		35, 016, 039		145, 152, 547	
1870	47, 143, 817		7, 345, 448		54, 488, 265	
		157, 280, 325		42, 361, 487		199, 641, 812
	157, 280, 325		42, 361, 487		199, 641, 812	
1875	104, 464, 944		6, 461, 588		110, 926, 532	
		261, 745, 269		48, 823, 075		310, 568, 344
	261, 745, 269		48, 823, 075		310, 568, 344	
1876	33, 265, 280		1, 305, 027		34, 570, 307	
		295, 010, 549		50, 128, 102		345, 138, 651
	295, 010, 549		50, 128, 102		345, 138, 651	
1877	41, 621, 245		1, 511, 152		43, 132, 397	
		336, 631, 794		51, 639, 254		388, 271, 048
	336, 631, 794		51, 639, 254		388, 271, 048	
1878	48, 030, 358		1, 336, 187		49, 366, 545	
		384, 662, 152		52, 975, 441		437, 637, 593
	384, 662, 152		52, 975, 441		437, 637, 593	
1879	40, 655, 120		1, 052, 231		41, 707, 351	
		425, 317, 272		54, 027, 672		479, 344, 944
	425, 317, 272		54, 027, 672		479, 344, 944	
1880	53, 298, 247		981, 361		54, 279, 608	
		478, 615, 519		55, 009, 033		533, 624, 552
	478, 615, 519		55, 009, 033		533, 624, 552	
1881	50, 702, 669		1, 270, 200		51, 972, 869	
		529, 318, 188		56, 279, 233		585, 597, 421
	529, 318, 188		56, 279, 233		585, 597, 421	
1882	28, 845, 830		994, 201		29, 840, 031	
		558, 164, 018		57, 273, 434		615, 437, 452
	558, 164, 018		57, 273, 434		615, 437, 452	
1883	27, 756, 082		980, 798		28, 736, 880	
		585, 920, 100		58, 254, 232		644, 174, 332
Total	585, 920, 100	....	58, 254, 232	....	644, 174, 332	

RANK OF STATES IN GRAIN PRODUCTION.

The fluctuation in production, which for several reasons is extreme in this country, is a troublesome factor in statistical calculation. If frosts injure wheat in this country, or cold rains blight the crop in Europe, and the price should advance, there might be a very large acreage the next year and possibly a larger crop. But the disaster might be so severe as to reduce the area, notwithstanding high prices. Very loose ideas of rotation prevail; if practiced at all, it is a system that is very flexible, to be modified by changing circumstances of the seasons and the markets.

So variable are the products of the several years that in three years three different States may lead in a crop. Therefore the rank of a State must be determined by its average product in a series of years. A table

has been prepared showing the rank of States during the last ten years. In comparisons drawn from it, it should be remembered that ten years is a long period in some of the newer States, and a period of five years would make a better showing for them.

In corn the prominence of certain States is so great that their rank is less liable to change by annual variations. The order of the ten of heaviest production is: Illinois, Iowa, Missouri, Indiana, Ohio, Kansas, Kentucky, Tennessee, Texas, and Pennsylvania.

Illinois also stands first in wheat, followed by Ohio, Indiana, California, Minnesota, Iowa, Michigan, Wisconsin, Missouri, and Pennsylvania. But three of these are spring wheat States.

The oats crop, though in its uses more nearly allied to corn, requires quite different climatic conditions. Therefore we find New York, Iowa, Wisconsin, Minnesota, and Michigan among the first ten in oats, all of which have a much lower rank as corn States. Buckwheat is a crop almost confined to the Northern States. Pennsylvania is first in rye and California in barley.

Rank of States in cereal production.

CORN.

States by rank.	Grand total.	Average for ten years.
	Bushels.	*Bushels.*
1. Illinois	2,177,889,496	217,788,950
2. Iowa	1,648,835,040	164,883,504
3. Missouri	1,108,966,208	110,896,621
4. Indiana	991,968,100	99,196,810
5. Ohio	991,192,900	99,119,290
6. Kansas	819,832,760	81,983,276
7. Kentucky	613,787,970	61,378,797
8. Tennessee	499,767,592	49,976,759
9. Texas	430,900,800	43,090,080
10. Pennsylvania	422,613,500	42,261,350
11. Nebraska	420,080,200	42,008,020
12. Wisconsin	274,521,582	27,452,158
13. North Carolina	257,864,520	25,786,452
14. Virginia	246,181,600	24,618,160
15. Michigan	243,114,801	24,311,480
16. Alabama	239,937,152	23,993,715
17. Georgia	237,955,140	23,795,514
18. Arkansas	222,268,950	22,226,895
19. Mississippi	216,418,380	21,641,838
20. New York	214,841,180	21,484,118
21. Maryland	142,637,320	14,263,732
22. Minnesota	128,356,550	12,835,655
23. Louisiana	118,327,820	11,832,782
24. West Virginia	116,207,000	11,620,700
25. South Carolina	108,443,100	10,844,310
26. New Jersey	99,407,200	9,940,720
27. Delaware	39,572,440	3,957,244
28. Nevada, Colorado, and Territories	31,066,347	3,106,635
29. Florida	26,394,730	2,639,473
30. California	22,092,950	2,209,295
31. Vermont	19,205,000	1,920,500
32. Connecticut	17,438,400	1,743,840
33. New Hampshire	16,223,920	1,622,392
34. Massachusetts	14,061,530	1,406,153
35. Maine	12,884,420	1,288,442
36. Rhode Island	2,931,680	293,168
37. Oregon	1,184,905	118,490
Total	13,195,373,183	1,319,537,318

WHEAT.

States by rank.	Grand total.	Average for ten years.
	Bushels.	*Bushels.*
1. Illinois	358,879,487	35,887,949
2. Ohio	311,285,825	31,128,582
3. Indiana	309,470,518	30,947,052
4. California	304,004,200	30,400,420
5. Minnesota	296,007,062	29,600,706
6. Iowa	293,859,245	29,385,924
7. Michigan	228,838,585	22,838,858
8. Wisconsin	208,265,255	20,826,525
9. Missouri	198,210,334	19,821,033
10. Pennsylvania	189,938,480	18,993,848
11. Kansas	174,198,500	17,419,850
12. New York	104,430,800	10,443,080
13. Tennessee	98,030,400	9,803,040
14. Nevada, Colorado, and Territories	94,225,900	9,422,590
15. Nebraska	92,552,167	9,255,217
16. Kentucky	88,129,132	8,812,913
17. Oregon	76,352,520	7,635,252
18. Virginia	75,618,262	7,561,826
19. Maryland	66,088,820	6,608,882
20. West Virginia	37,638,891	3,763,889
21. North Carolina	36,815,313	3,681,531
22. Texas	36,113,012	3,611,301
23. Georgia	30,653,374	3,065,337
24. New Jersey	21,068,263	2,106,826
25. Arkansas	13,288,168	1,328,817
26. Alabama	13,041,378	1,304,138
27. Delaware	9,631,985	963,198
28. South Carolina	9,370,300	937,030
29. Vermont	4,309,325	430,932
30. Maine	3,982,504	398,250
31. Mississippi	3,233,266	323,327
32. New Hampshire	1,783,020	178,302
33. Connecticut	379,872	37,987
34. Massachusetts	229,881	22,988
35. Louisiana	12,850	1,285
36. Florida	830	83
37. Rhode Island	780	78
Total	3,789,938,504	378,993,850

OATS.

States by rank.	Grand total.	Average for ten years.
	Bushels.	*Bushels.*
1. Illinois	581,530,700	58,153,070
2. New York	385,615,318	38,561,532
3. Iowa	352,593,760	35,259,376
4. Pennsylvania	344,217,320	34,421,732
5. Wisconsin	276,862,128	27,686,213
6. Ohio	244,650,690	24,465,069
7. Missouri	196,322,924	19,632,292
8. Minnesota	176,242,425	17,624,242
9. Indiana	148,838,688	14,883,869
10. Michigan	135,807,770	13,580,777
11. Kansas	109,478,320	10,947,832
12. Kentucky	65,583,720	6,558,372
13. Virginia	60,504,140	6,050,414
14. Georgia	57,347,780	5,734,778
15. Tennessee	55,878,010	5,587,801
16. Nebraska	51,886,800	5,188,680
17. Texas	46,438,340	4,643,834
18. New Jersey	41,096,100	4,109,610
19. North Carolina	41,017,200	4,101,720
20. Vermont	39,362,516	3,936,252
21. Nevada, Colorado, and Territories	38,286,000	3,828,600
22. Oregon	33,779,162	3,377,916
23. Maryland	30,120,820	3,012,082
24. West Virginia	25,419,420	2,541,942
25. California	24,803,200	2,480,320
26. Maine	22,038,525	2,203,852
27. Alabama	21,424,116	2,142,412
28. South Carolina	17,918,120	1,791,812
29. Arkansas	16,309,874	1,630,987
30. Mississippi	13,449,760	1,344,976
31. New Hampshire	11,473,600	1,147,360
32. Connecticut	10,724,635	1,072,463
33. Massachusetts	6,347,509	634,751
34. Delaware	3,885,330	388,533
35. Florida	2,300,100	230,010
36. Louisiana	1,419,300	141,930
37. Rhode Island	1,287,250	128,725
Total	3,692,261,370	369,226,137

Rank of States in cereal production—Continued.

RYE.

States by rank.	Grand total.	Average for ten years.
	Bushels.	*Bushels.*
1. Pennsylvania	36, 941, 145	3, 694, 115
2. Illinois	31, 061, 860	3, 106, 186
3. New York	28, 049, 171	2, 804, 917
4. Wisconsin	21, 213, 320	2, 121, 332
5. Kansas	18, 090, 766	1, 809, 077
6. Kentucky	9, 985, 955	998, 595
7. Iowa	6, 960. 652	696, 065
8. New Jersey	6, 313, 652	681, 365
9. Missouri	6, 123, 240	612, 324
10. Ohio	5, 631, 880	563, 188
11. Nebraska	4, 570, 900	457, 090
12. Virginia	4, 438, 200	443, 820
13. Connecticut	4, 072, 750	407, 275
14. Indiana	3, 939, 978	393, 998
15. North Carolina	3, 659, 194	365, 919
16. Massachusetts	3, 554, 310	355, 431
17. Maryland	3, 107, 010	310, 701
18. Michigan	2, 592, 616	259, 262
19. West Virginia	2, 538, 813	253, 881
20. Tennessee	2, 484, 691	248, 469
21. Minnesota	1, 870, 450	187, 045
22. California	1, 372, 935	137, 294
23. Georgia	871, 102	87, 110
24. Vermont	809, 036	80, 904
25. Texas	427, 782	42, 778
26. Arkansas	423, 860	42, 386
27. Nevada and Territories	411, 604	41, 160
28. New Hampshire	409, 460	40, 946
29. South Carolina	393, 460	39, 346
30. Maine	358, 432	35, 843
31. Louisiana	244, 600	24, 460
32. Rhode Island	203, 735	20, 373
33. Alabama	159, 766	15, 977
34. Oregon	128, 446	12, 845
35. Delaware	111, 309	11, 131
36. Mississippi	55, 262	5, 526
37. Florida	6, 624	662
Total	214, 087, 966	21, 408, 796

BARLEY.

States by rank.	Grand total.	Average for ten years.
	Bushels.	*Bushels.*
1. California	113, 344, 136	11, 334, 414
2. New York	69, 631, 665	6, 963, 166
3. Iowa	47, 935, 548	4, 793, 555
4. Wisconsin	35, 922, 390	3, 592, 239
5. Minnesota	26, 047, 760	2, 604, 776
6. Illinois	17, 509, 525	1, 750, 952
7. Nevada and Territories	10, 860, 552	1, 086, 055
8. Ohio	10, 846, 029	1, 084, 603
9. Nebraska	10, 288, 430	1, 028, 843
10. Michigan	10, 136, 960	1, 013, 696
11. Kansas	9, 229, 004	922, 900
12. Pennsylvania	5, 444, 076	544, 408
13. Oregon	5, 296, 630	529, 711
14. Maine	5, 263, 779	526, 378
15. Indiana	4, 208, 600	420, 860
16. Kentucky	3, 212, 200	321, 220
17. Missouri	1, 755, 904	175, 590
18. Vermont	1, 729, 774	172, 977
19. New Hampshire	919, 000	91, 900
20. Massachusetts	794, 252	79, 425
21. Texas	644, 480	64, 448
22. Tennessee	445, 685	44, 568
23. West Virginia	355, 912	35, 591
24. Connecticut	202, 154	20, 215
25. Rhode Island	155, 455	15, 545
26. Georgia	102, 290	10, 229
27. Virginia	47, 225	4, 722
28. South Carolina	46, 805	4, 680
29. Maryland	33, 124	3, 312
30. New Jersey	22, 816	2, 282
31. Alabama	19, 638	1, 964
32. North Carolina	11, 525	1, 152
33. Delaware	3, 500	350
Total	392, 466, 823	39, 246, 682

BUCKWHEAT.

States by rank.	Grand total.	Average for ten years.
	Bushels.	*Bushels.*
1. New York	40, 027, 172	4, 002, 717
2. Pennsylvania	27, 914, 991	2, 791, 499
3. Michigan	5, 489, 480	548, 948
4. Maine	4, 278, 600	427, 860
5. Wisconsin	4, 156, 789	415, 679
6. Vermont	3, 853, 390	385, 339
7. New Jersey	3, 672, 180	367, 218
8. Ohio	2, 834, 331	283, 433
9. West Virginia	1, 783, 488	178, 349
10. Illinois	1, 618, 100	161, 810
11. Iowa	1, 344, 703	134, 470
12. Connecticut	1, 284, 453	128, 445
13. Indiana	1, 193, 110	119, 311
14. Virginia	981, 527	98, 153
15. New Hampshire	946, 956	94, 696
16. Maryland	945, 880	94, 588
17. Kansas	858, 847	85, 885
18. Tennessee	692, 880	69, 288
19. Minnesota	680, 730	68, 073
20. Massachusetts	589, 590	58, 959
21. Missouri	487, 442	48, 744
22. North Carolina	237, 776	23, 778
23. Nebraska	227, 000	22, 700
24. California	124, 080	12, 408
25. Kentucky	28, 230	2, 823
26. Oregon	16, 212	1, 621
27. Delaware	14, 225	1, 422
28. Nevada and Territories	7, 287	729
29. Rhode Island	2, 659	266
Total	106, 292, 108	10, 629, 211

CONSUMPTION AND DISTRIBUTION OF CORN AND WHEAT.

For two years past efforts have been made for the first time to ascertain approximately the consumption of the corn and wheat supply of the year on the first day of March. The purpose is to show the rate of distribution, and to indicate the extent of consumption at that date. The result is exceedingly interesting and valuable. It reveals facts so numerous, so various, and local conditions of consumption so peculiar and diverse as to prove practically a revelation to local agricultural writers and to commercial editors. This is especially the case as to corn. Among the points presented are—

1. That the average stock of corn on hand at this date in a series of years is one-third, two-thirds having been consumed on the farm or shipped away.

2. That nearly-five sixths of the corn shipped from the county where grown goes from seven States, known as the corn-surplus States; and most of the remainder from Kentucky and Tennessee.

3. That 44 per cent. of the corn is fed to cattle and swine (for meat-making) in the counties where grown; 28 per cent. is fed to work-animals in the operations of the farm, and 8 per cent. used as human food. Most of the 20 per cent. shipped from the counties are also used in the East and South for the various purposes above named. This would make the distribution nearly—

	Per cent.
For feeding for meat	50
For feeding for work	30
For human food	9
For exportation	5
For spirits, glucose, starch, seed, and waste	6

4. That in the South about half is used for work-animals and a fourth for meat; while in the West half goes for making meat and one-fifth for farm work.

5. That the above diversities as to use in home consumption make large difference in the time of consumption. In the South, 43.5 per cent. remained on hand March 1, because of the large crop, and its required use for five months of spring and summer plowing.

The smaller former average in the South, 35.9 per cent., is not because of a change in the usage as to consumption, but because the smaller former supply was earlier exhausted, and purchases from the West large after that date. In the West only a third remained on hand, because the heaviest feeding comes in autumn and early winter.

CORN.

Proportion on hand March 1.—The returns of March 1, 1883, showed that about 36 per cent. of the crop still remained in the hands of the growers, or about 558,000,000 bushels of 1,617,000,000 bushels representing the crop of 1882. Nearly two-thirds of this amount was in the Western States, and about three-tenths in the Southern States.

Comparing with an average of the five preceding years, one of which (1881) was a year of great scarcity, we find that New England had less than that average; the Middle States, 37.4 per cent., the average being 36.7; the Southern States, 43.5 per cent., instead of 35.9; the Western States only a fraction more than such average, or 33.8 per cent., in place of 32.9 per cent.; the Pacific coast, 25.1, the average being 24.5 per cent.; and the Territories, 35 per cent., a very large increase, due to

the development of corn culture in Dakota. The following statement shows these percentages and the quantities they represent:

Sections.	Production.	Stock on hand March 1, 1883.		Average per cent. for five years.
	Bushels.	Per cent.	Bushels.	
New England	6, 376, 300	29. 8	1, 898, 701	32. 6
Middle	78, 585, 700	37. 4	29, 397, 288	36. 7
Southern	394, 695, 300	43. 5	171, 551, 062	35. 9
Western	1, 127, 934, 500	33. 8	381, 600, 606	32. 9
Pacific	2, 920, 900	25. 1	741, 908	24. 5
Nevada, Colorado, and Territories	6, 512, 400	35. 0	2, 282, 552	25. 5
Total	1, 617, 025, 100	36. 3	587, 472, 117	33. 7

It is seen that the only stocks contributing appreciably to the aggregate are those of the West, South, and the Middle States. The statement by States and Territories is as follows:

States.	Product in 1882.	Stock on hand March 1, 1883.		Per cent. for five years.
	Bushels.	Bushels.	Per. ct.	
Maine	904, 400	253, 232	28	30
New Hampshire	870, 700	261, 210	30	32
Vermont	1, 930, 300	656, 302	34	35
Massachusetts	1, 237, 200	346, 416	28	32
Rhode Island	277, 900	69, 475	25	27
Connecticut	1, 155, 800	312, 066	27	33
New York	21, 187, 500	7, 627, 500	36	37
New Jersey	9, 942, 800	3, 778, 264	38	36
Pennsylvania	43, 518, 800	16, 101, 956	37	36
Delaware	3, 936, 600	1, 889, 568	48	45
Maryland	17, 904, 700	8, 057, 115	45	43
Virginia	35, 904, 000	15, 797, 760	44	40
North Carolina	34, 260, 700	15, 759, 922	46	43
South Carolina	16, 356, 200	6, 869, 604	42	37
Georgia	36, 617, 500	18, 674, 925	51	33
Florida	3, 708, 900	1, 594, 827	43	40
Alabama	31, 982, 500	15, 351, 600	48	35
Mississippi	30, 233, 600	14, 209, 792	47	35
Louisiana	14, 636, 400	5, 708, 196	39	35
Texas	63, 416, 300	23, 464, 031	37	34
Arkansas	34, 485, 900	14, 484, 078	42	35
Tennessee	75, 188, 600	31, 579, 212	42	33
West Virginia	14, 927, 000	6, 269, 340	42	34
Kentucky	75, 500, 900	30, 955, 369	41	33
Ohio	93, 319, 200	27, 062, 568	29	28
Michigan	28, 581, 600	8, 574, 480	30	28
Indiana	107, 484, 300	38, 694, 348	36	33
Illinois	182, 336, 900	67, 464, 653	37	39
Wisconsin	32, 201, 600	9, 660, 480	30	28
Minnesota	21, 127, 600	6, 127, 004	29	27
Iowa	175, 487, 600	52, 646, 280	30	36
Missouri	170, 037, 000	51, 011, 100	30	28
Kansas	144, 452, 600	47, 669, 358	33	30
Nebraska	82, 478, 200	35, 465, 626	43	38
California	2, 790, 900	725, 634	26	25
Oregon	130, 000	13, 000	10	10
Nevada	18, 000	3, 600	20	18
Colorado	422, 400	160, 512	38	33
Arizona	57, 000	20, 520	36	32
Dakota	4, 650, 000	1, 720, 500	37	25
Idaho	45, 000	13, 500	30	28
Montana	18, 000	5, 400	30	28
New Mexico	965, 000	270, 200	28	25
Utah	275, 000	66, 000	24	22
Washington	62, 000	22, 320	36	33
Wyoming	....	....	......	.....
Indian	....	....	......	.....
Total	1, 617, 025, 100	587, 468, 843	36. 3	33.7

The largest proportions on hand are those of the Southern States. This is in accordance with intelligent expectation, not because there is any surplus for shipment, nor because more is consumed than in the West. On the contrary, the requirements of that region are far smaller than of the States where pork and beef are made. The larger portion is used for feeding the horses and mules employed so constantly in plowing during the spring and early summer. Pork is not made for shipment, and only a partial supply for home consumption, from mast, and the run of the pea field, and a limited supply of corn towards killing time. These conditions are reflected in the results of this inquiry, showing a great contrast with Western practice.

Consumption.—Inquiry was made as to proportions used for specific purposes, to illustrate the rural economy of different sections of the country, under the following heads, viz: (A) human food; (B) feed for work animals; (C) feed for cattle and swine; (D) shipped out of country where produced.

In the first inquiry the percentage would be expected to vary from two causes—the amount produced per capita, and the comparative use of maize for human food, which differs greatly in the different States. In New England its use is quite limited, and not confined to the home product; but very little is grown, so that the percentage is larger, though the quantity is not. In the South the quantity is greater, but less than in the West, so that sixteen per cent. is required in the former, and but five in the latter States, though the aggregate Southern requirement is not very greatly in excess of Western, 63,000,000 bushels against 56,000,000 bushels. The quantity of native corn reported as used for food in the South is 4.6 bushels per capita; in the West, nearly 3 bushels. In the Middle States, and in New England, the native supply is supplemented by corn from other States, increasing the consumption as reported; the population is largely in cities and towns, and the rural population small. The total reported as used for food in the country, of nearly 130,000,000 bushels, may probably be increased by 20,000,000 more from the column which reports corn "shipped out of the county" in which it is grown, making an aggregate of 150,000,000 bushels or nearly three bushels per capita. This is very unequally distributed, some communities using twice this average, and others a scarcely appreciable quantity.

In the use of corn for feed of work-animals is seen a marked difference between Western and Southern usages and rural methods. The per cent. of corn used for this purpose in the Southern States is placed at 47.2. As the supplies brought from the West are almost entirely used for work-animals or human food, the real proportion of corn consumption is fully one-half for such feeding. In the West it is one-fifth, or 20.9 per cent. Yet the quantity used is 235,000,000 bushels. The larger relative use of corn for work-animals in the South is due to the fact that plowing is almost continuous from March to July, inclusive; that more horses and mules are required in proportion to work done, and corn is the principal feed. In the West there is less cultivation, wheat taking the place of cotton, and requiring no culture after planting, while horses feed upon hay as well as corn, and use oats much more extensively than in the South. Everything in crop and cultivation, in work and ration of animals, conspires to widen the relative requirement of corn for work-animals of these two belts of States.

The consolidation of returns makes the proportion used for feeding work-animals 28 per cent. Taking into account receipts from beyond county (and State) lines the proportion may be stated at 30 per cent.

The third branch of consumption relates to meat production. It also includes, to a limited extent, milk production. Beef, pork, and mutton all require an increasing proportion of corn, supplementary to grass products and rougher forage in summer droughts and winter severities, especially in the finishing process. Eggs and poultry demand a share of the maize supply. Half of the crop in the West appears to be used as feed for cattle, sheep, and swine. Applying the percentage to the present crop the grand volume of 557,000,000 bushels is indicated. As only one-fourth is shipped from counties where grown, and little more than one-fifth can be traced to Chicago, Toledo, New York, and all other distant markets, it is evident that the other fourth is ample for working animals and home food. When we recount the various uses of corn in every stage of cattle life, and for ripening 12,000,000 swine (more or less) for the packing trade, and some millions more for farmer's use, and a further requirement for sheep and poultry, it would seem that 50 per cent. of the Western crop might be used for these purposes. The use of corn for spirits has not been mentioned, because it is usually only about one per cent. of the crop. Seed requires not more than one per cent. In this calculation it is proper to say that the entire crop is accounted for. Yet it should be remembered that the farmers' cribs were bare of corn at the beginning of the year, and that they will not be so thoroughly exhausted at its end. However short the stock may be, which Chicago is able to drain, there will be scattered through twenty States many million bushels more than existed there at the beginning of the year. The actual consumption (excluding exportation, seed, &c.) will not much exceed 1,450,000 bushels. This is more than an average consumption, even of recent years, but with rapidly increasing population, a large export demand, and the necessity for beef of earlier maturity and better quality, it will not be too large a quantity for the future.

Shipped from the county.—As the returns were made by counties, the portion shipped does not necessarily mean shipped to the seaboard, or beyond State lines. It must include, however, all such shipments. The aggregate of this branch of the inquiry is about 330,000,000 bushels, which is ample to account for exportation, eastern and southern shipments, and leave a margin for shipments short distances for local supply of towns and cities, and the requirements of neighboring feeders. Seven-eighths of this county surplus is in the West. The largest quantity is in Illinois; and Kansas, Iowa, and Missouri follow in order. Iowa's portion is greatly reduced by the very poor crop of last year. Kentucky and Tennessee have a much larger surplus than usual.

The statement of this division of local consumption, according to specific uses, is thus made:

Sections.	Human food.		Feed for work-animals.		Feed for cattle and swine.		Shipped from county.	
	Pr.ct.	Bushels.	Pr.ct.	Bushels.	Pr.ct.	Bushels.	Pr.ct.	Bushels.
New England	14	894, 089	29. 4	1, 873, 651	54. 2	3, 457, 579	2. 4	150, 981
Middle	9. 2	7, 224, 526	32. 7	25, 755, 430	47. 3	37, 144, 801	10. 8	8, 460, 943
Southern	16	63, 185, 261	47. 2	186, 306, 987	26. 3	103, 953, 517	10. 5	41, 249, 535
Western	5	56, 499, 363	20. 9	235, 227, 078	49. 4	557, 237, 200	24. 7	278, 970, 859
Pacific	30. 8	898, 979	24. 3	701, 625	34. 6	1, 016, 506	10. 3	303, 790
Nevada, Colorado, and Territories	15. 3	996, 397	43. 1	2, 806, 844	29. 2	1, 966, 745	11. 4	742, 414
Total	8	129, 698, 615	28	452, 671, 615	43. 6	704, 776, 348	20. 4	329,878, 522

Allowing for the export reserve, and for a moderate filling of the usual stocks held over (which were so depleted last year), and for the requisite conversion of corn into spirits, glucose, starch, and the seed for sixty-five million acres or more to be planted, the actual consumption of the year for man and beast may thus be stated, after distribution of the remnant of the county surplus not required for the miscellaneous uses indicated above:

	Bushels.
For human food	150,000,000
For feed of work-animals	520,000,000
For feed for meat-producing animals	780,000,000
Total	1,450,000,000
Leaving for export, seed, spirits, and surplus	167,025,100

The returns by States are as follows:

States.	Human food.		Food for work-animals.		Food for cattle and swine.		Shipped from county.	
	Bushels.	Pr.ct.	Bushels.	Pr.ct.	Bushels.	Pr.ct.	Bushels.	Pr.ct.
Maine	198,968	22	271,320	30	416,024	46	18,088	2
New Hampshire	130,605	15	235,089	27	487,592	56	17,414	2
Vermont	231,636	12	540,484	28	1,080,968	56	77,212	4
Massachusetts	160,836	13	420,648	34	643,344	52	12,372	1
Rhode Island	33,348	12	105,602	38	136,171	49	2,779	1
Connecticut	138,696	12	300,508	26	693,480	60	23,116	2
New York	2,118,750	10	6,356,250	30	11,653,125	55	1,059,375	5
New Jersey	795,424	8	3,778,264	38	3,977,120	40	1,391,992	14
Pennsylvania	3,916,692	9	14,361,204	33	20,018,648	46	5,222,256	12
Delaware	393,660	10	1,259,712	32	1,495,908	38	787,320	20
Maryland	1,611,423	9	6,445,692	36	5,908,551	33	3,939,034	22
Virginia	5,744,640	16	13,643,520	38	11,130,240	31	5,385,600	15
North Carolina	6,852,140	20	13,704,280	40	9,935,603	29	3,768,677	11
South Carolina	4,089,050	25	9,159,472	56	2,944,116	18	163,562	1
Georgia	8,788,200	24	16,844,050	46	8,055,850	22	2,929,400	8
Florida	927,225	25	2,114,073	57	519,246	14	148,356	4
Alabama	7,036,150	22	16,311,075	51	6,716,325	21	1,918,950	6
Mississippi	6,349,056	21	16,023,808	53	6,651,392	22	1,209,344	4
Louisiana	2,927,280	20	8,781,840	60	2,341,824	16	585,456	4
Texas	7,609,956	12	36,147,291	57	15,219,912	24	4,439,141	7
Arkansas	4,483,167	13	19,312,104	56	8,966,334	26	1,724,295	5
Tennessee	6,766,974	9	27,819,782	37	25,564,124	34	15,037,720	20
West Virginia	1,791,240	12	5,970,800	40	6,120,070	41	1,044,890	7
Kentucky	6,040,072	8	24,160,288	32	32,465,387	43	12,835,153	17
Ohio	5,599,152	6	25,196,184	27	46,659,600	50	15,864,264	17
Michigan	2,572,344	9	8,860,296	31	15,434,064	54	1,714,896	6
Indiana	5,374,215	5	25,796,232	24	52,667,307	49	23,646,546	22
Illinois	7,293,476	4	32,820,642	18	83,874,974	46	58,347,808	32
Wisconsin	2,576,128	8	7,084,352	22	18,354,912	57	4,186,208	13
Minnesota	1,478,932	7	5,704,452	27	11,408,904	54	2,535,312	12
Iowa	7,019,504	4	28,078,016	16	96,518,180	55	43,871,900	25
Missouri	8,501,850	5	34,007,400	20	91,819,980	54	35,707,770	21
Kansas	5,778,104	4	26,001,468	18	66,448,196	46	46,224,832	32
Nebraska	2,474,346	3	11,546,948	14	35,465,626	43	32,991,280	40
California	865,179	31	697,725	25	948,906	34	279,090	10
Oregon	33,800	26	3,900	3	67,600	52	24,700	19
Nevada	.....	.....	.....	.....	.....	.....	.....	.....
Colorado	50,688	12	215,424	51	80,256	19	76,032	18
Arizona	17,100	30	28,500	50	11,400	20	.....	.....
Dakota	604,500	13	1,999,500	43	1,534,500	33	511,500	11
Idaho	.....	.....	.....	.....	.....	.....	.....	.....
Montana	.....	.....	.....	.....	.....	.....	.....	.....
New Mexico	250,900	26	463,200	48	154,400	16	96,500	10
Utah	33,000	12	85,250	31	112,750	41	44,000	16
Washington	37,200	60	6,200	10	6,200	10	12,400	20

THE CORN-SURPLUS STATES.

Practically we have only to consider the surplus-corn States in an inquiry concerning the corn of commerce or current and prospective

prices. Commercial prices are made by the production of seven States. In addition to these Kentucky and Tennessee usually add something to this surplus, ordinarily not enough to affect prices. In two of these seven, Illinois and Iowa, the crop of 1882 was not much superior to that of 1881, and the available supply of the present year actually less than that of last year, which had a larger stock left over from the previous year's supply. The local prices in those States are, therefore, comparatively high. The following statement shows the proportion and quantity on hand in those States March 1, 1883:

States.	Crop.	Stock.	Per cent.
	Bushels.	*Bushels.*	
Ohio	93, 319, 200	27, 062, 568	29
Indiana	107, 484, 300	38, 694, 348	36
Illinois	182, 336, 900	67, 464, 653	37
Iowa	175, 487, 600	52, 646, 280	30
Missouri	170, 037, 000	51, 011, 100	30
Kansas	144, 452, 600	47, 669, 358	33
Nebraska	82, 478, 200	35, 465, 626	43
Total	955, 595, 800	320, 013, 933	33

The proportion of Illinois on hand at this date is ordinarily much larger than that of other States. In 1881 it was 45 per cent., or 35,000,000 to 40,000,000 bushels more than the present remainder. The percentage is about the same as that of 1882. Iowa has a smaller proportion on hand than last year, and less than half the number of bushels remaining on the 1st of March, 1881. The comparison of the stock on hand in the seven States is, in round numbers, as follows:

	Bushels.
March 1, 1883	320, 000, 000
March 1, 1882	200, 000, 000
March 1, 1881	413, 000, 000

EFFECT OF SCARCITY UPON PRICE.

The average farm price for the crop of the entire country from 1871 to 1881, inclusive, has been 43 cents. In the last five years of this period it failed to reach 40 cents, except in 1881, when it was 63 cents. It is above the average now, from the gradually increasing use of corn in meat-making, but mainly from its comparative scarcity, the last crop averaging only 24 bushels per acre, or 4 bushels less than the census crop of 1879. That crop furnished a supply of 35 bushels per capita; the crop of last year only 30 bushels per head, counting present population at 54,000,000. The bare garners of last fall make this difference still greater.

SMALL ANNUAL SURPLUS.

At the same time the intelligent observer, at all conversant with the facts of farm economy, cannot fail to see that this surplus held over to augment the following year's supply must always be small, say 5 or 6 per cent. usually, and scarcely exceeding 10 in years of exceptional abundance. In three-fourths of all corn-producing counties there is next to absolute exhaustion of corn cribs every year; in a few, in the great maize sections, there is sometimes a liberal proportion held over. One hundred and fifty million bushels in all the States would be an extraordinary surplus in any season.

ANNUAL RATE OF CONSUMPTION.

There is another error that should be guarded against—the thoughtless assumption of an equal rate of consumption throughout the year, summer as well as winter. No farmer, intelligent or otherwise, would make this blunder, which is broached, though probably not accepted to any appreciable extent, in commercial quarters. It is evident that the consumption in December in the feeding States, where three-fourths of the corn is grown and two-thirds of it consumed, is five times—in some of them ten times—as much in December as in June. And yet there are those who thoughtlessly assume that the consumption, if an average of 100,000,000 bushels per month, must necessarily be in equal quantity each month. It would scarcely seem to be necessary to make this explanation, yet the vagaries of commercial statement render it important to a proper understanding of the true meaning of these returns, which fairly represent, in approximate figures, the varied conditions which affect consumption, showing uniformity in proportion consumed only between those States in which such conditions are similar. In this way internal evidence is afforded of the substantial correctness of the several results.

CONSUMPTION IN THE PAST.

There is a chance for misconception of the actual requirements of consumption from the rapid increase of the past twelve years, which is sufficiently large, but much of it is more apparent than real. The year 1869 was one of low production of corn, and the census of 1880 was very incomplete in the South, making the record of 1870 positively less than that of 1860. This was deceptive, misleading the press, which proclaimed a decline in corn culture, whereas there was an increase in acreage. The census made 760,944,549 bushels, a figure 10 per cent. too low for 1869, for that season, and 33 per cent. less than a good season would have made. The Department of Agriculture made 874,320,000 bushels for the same year and fairly represented the real status of the crop. The area was sufficient for a crop of 1,000,000,000, and in 1870 a product of nearly 1,100,000,000 was obtained.

The increase in area has been gradual, and no such boom has occurred as the unthinking and misinformed observer is disposed to believe. Nor has the Department of Agriculture made very low estimates except in 1878 and 1879, the causes of which are obvious. Reviewing the production of five years for 1877 and 1881, inclusive, in the light of census and department work combined, the average product, exclusive of an average of about 82,500,000 bushels exported, would admit of a consumption for all purposes of nearly 1,400,000,000 bushels. For ten years the consumption has averaged about 1,275,000,000 bushels, the exportation nearly 65,000,000 bushels.

The increase has been gradual and comparatively uniform. The competition of one crop with another and the practical difficulty of much annual change in the aggregate area of all crops, except by the steady increase of farms and farmers, forbid the spasmodic and extreme enlargement of the area of any crop. Every accurate enumeration, State or national, fortifies this position and exposes the absurdities so often set afloat in this era of speculation.

The comparative yield of corn per acre, in the different sections, which

is illustrated by Diagram 1, is accounted for by climate, soil, and cultivation.

WHEAT.

The returns of wheat indicated a remainder of 28 per cent. of the crop on the 1st of March, or about 143,000,000 bushels. This appears to be very slightly in excess of the average stock at that date in previous years. The statement by sections is as follows:

Sections.	Crop of 1882.	Stock on hand March 1, 1883.		For five years.
	Bushels.	Per cent.	Bushels.	Per cent.
New England	1,103,020	37.0	408,234	38.1
Middle	35,745,200	35.6	12,734,908	34.7
Southern	45,673,450	25.0	11,462,374	22.0
Western	354,387,700	29.2	103,383,660	27.1
Pacific	48,085,900	28.2	12,621,301	25.9
Colorado, Nevada, and Territories	19,190,200	23.1	4,418,256	22.9
Total	504,185,470	28.8	145,028,733	26.9

The proportion of increase is large in the South, and yet the quantity is small. In the West about 2 per cent. more than usual remained on hand, or nearly three-tenths of the crop. The largest quantity appeared to be held in Ohio, apparently for higher prices.

In comparison with the previous years, an investigation a year ago supplies data for the following statement:

	Bushels.
Wheat on hand March 1, 1883	143,000,000
Wheat on hand March 1, 1882	98,000,000
Wheat on hand March 1, 1881	145,000,000

The local consumption, and shipments from counties where grown, are given as follows, by sections:

Sections.	Consumed in the county.		Shipped out of the county.	
	Per cent.	Bushels.	Per cent.	Bushels.
New England	99.0	1,092,486	1.0	10,534
Middle	60.8	21,742,277	39.2	14,002,923
Southern	57.4	26,217,408	42.6	19,456,042
Western	39.9	141,291,610	60.1	213,096,090
California and Oregon	24.8	11,910,369	75.2	36,175,531
Colorado, Nevada, and Territories	39.7	7,621,508	60.3	11,568,692
Total	41.6	209,875,658	58.4	294,309,812

In the consumption in county where grown is included that manufactured by local mills, and more than 50,000,000 bushels used in seeding the area of the crop of 1883.

The statement of stock on hand, and also the proportion usually consumed or manufactured in the county, and that shipped out of the county, is given as follows:

States.	Crop of 1882.	Stock on hand March 1, 1883.		Average per cent. for five years.	Consumed in county.	Shipped from county.
	Bushels.	Bushels.	Per ct.		Bushels.	Bushels.
Maine	512, 100	158, 751	31	32	512, 100	....
New Hampshire	148, 700	53, 532	36	40	145, 726	2, 974
Vermont	378, 000	170, 100	45	45	370, 440	7, 560
Massachusetts	20, 100	6, 231	31	31	20, 100	....
Rhode Island	520	....	....	....	520	....
Connecticut	43, 600	19, 620	45	47	43, 600	....
New York	12, 145, 200	4, 250, 820	35	34	8, 501, 640	3, 643, 560
New Jersey	2, 098, 700	671, 584	32	33	1, 595, 012	503, 688
Pennsylvania	20, 300, 700	7, 308, 252	36	32	11, 165, 385	9, 135, 315
Delaware	1, 200, 600	504, 252	42	40	480, 240	720, 360
Maryland	8, 655, 600	1, 990, 788	23	20	2, 596, 680	6, 058, 920
Virginia	8, 311, 400	1, 911, 622	23	22	3, 241, 446	5, 069, 954
North Carolina	5, 494, 800	1, 813, 284	33	30	4, 505, 736	989, 064
South Carolina	1, 729, 000	518, 700	30	20	1, 677, 130	51, 870
Georgia	3, 812, 900	953, 225	25	20	3, 088, 449	724, 451
Florida	350	....	....	....	350	....
Alabama	1, 700, 800	391, 184	23	21	1, 564, 736	136, 064
Mississippi	250, 100	45, 018	18	15	250, 100	....
Louisiana	7, 500	....	....	....	7, 500	....
Texas	4, 173, 700	1, 085, 162	26	21	3, 046, 801	1, 126, 899
Arkansas	1, 566, 100	263, 203	23	23	1, 252, 880	313, 220
Tennessee	9, 971, 200	2, 393, 088	24	21	4, 985, 600	4, 985, 600
West Virginia	4, 854, 300	1, 504, 833	31	29	2, 912, 580	1, 941, 720
Kentucky	17, 250, 000	4, 140, 000	24	20	8, 107, 500	9, 142, 500
Ohio	43, 453, 600	15, 208, 760	35	30	16, 077, 832	27, 375, 768
Michigan	32, 315, 400	10, 340, 928	32	30	9, 694, 620	22, 620, 780
Indiana	45, 461, 800	12, 729, 304	28	24	17, 275, 484	28, 186, 316
Illinois	52, 302, 900	10, 983, 609	21	24	20, 921, 160	31, 381, 740
Wisconsin	23, 145, 400	8, 332, 344	36	30	11, 109, 792	12, 035, 608
Minnesota	33, 030, 500	10, 569, 760	32	31	8, 587, 930	24, 442, 570
Iowa	25, 487, 200	7, 901, 032	31	32	16, 821, 552	8, 665, 648
Missouri	27, 538, 600	6, 884, 650	25	22	11, 015, 440	16, 523, 160
Kansas	31, 248, 000	9, 209, 440	28	26	11, 966, 720	19, 281, 280
Nebraska	18, 300, 000	5, 709, 000	33	28	6, 801, 000	11, 499, 000
California	36, 046, 600	8, 291, 184	24	28	9, 382, 116	26, 664, 484
Oregon	12, 039, 300	2, 528, 253	21	20	2, 528, 253	9, 511, 047
Nevada	95, 000	25, 650	27	28	76, 000	19, 000
Colorado	1, 598, 200	527, 406	33	30	623, 298	974, 902
Arizona	220, 000	61, 600	28	28	165, 000	55, 000
Dakota	11, 460, 000	2, 192, 000	20	22	2, 740, 000	8, 720, 000
Idaho	650, 000	175, 500	27	25	455, 000	195, 000
Montana	685, 000	178, 100	26	26	445, 250	239, 750
New Mexico	767, 000	191, 750	25	26	636, 610	130, 390
Utah	1, 250, 000	350, 000	28	27	900, 000	350, 000
Washington	2, 440, 000	610, 000	25	24	1, 561, 600	878, 400
Wyoming	25, 000	6, 250	25	25	18, 750	6, 250
Indian	....	....	....	....	....	....
Total	503, 185, 470	143, 356, 869	28. 5	26. 9	210, 067, 288	293, 109, 812

INCREASE OF FARMS.

With the increase of farms has come a large addition to their number and to the area of farm lands. The number has been enlarged both by taking up virgin lands and by subdivision of old farms—in the distant West by new lands, in the South mainly by dividing the old plantations. In groups of States the comparison of census results is thus made:

Groups.	Number of farms.			Acres in farms.		
	1880.	1870.	Per cent. increase.	1880.	1870.	Per cent. increase.
United States	4, 008, 907	2, 659, 985	50. 7	536, 081, 835	407, 735, 041	31. 5
North Atlantic Group	696, 139	601, 595	15. 7	67, 985, 640	62, 744, 384	8. 4
South Atlantic Group	644, 429	374, 102	72. 3	101, 419, 563	90, 213, 055	12. 4
Northern Central Group	1, 697, 968	1, 125, 078	50. 9	206, 982, 157	139, 215, 269	48. 7
Southern Central Group	886, 648	510, 998	73. 5	133, 500, 223	99, 343, 247	34. 4
Western Group	83, 723	48, 212	73. 7	26, 194, 252	16, 219, 086	61. 5

The increase by subdivision is largest in the cotton-growing States, where the share-tenant system prevails. In Texas the increase is both by subdivision and new lands, the area in farms having nearly doubled in ten years, while in Alabama the enlargement of area is only 26 per cent., though the number of farms is doubled. The South Atlantic Group shows an increase of 12.4 per cent. in lands, with 72.3 increase in number of farms.

In the Northern Central Group the increase in area and number of farms is nearly the same; it is not much different in the Western Group. Yet there is a marked tendency everywhere to a decrease in the average size of farms.

Increase in area and number of farms.

States and Territories.	Number of farms. 1880.	Number of farms. 1870.	Per cent. increase.	Acres in farms. 1880.	Acres in farms. 1870.	Per cent. increase.
United States	4,008,907	2,659,985	50.7	536,081,835	407,735,041	31.5
NORTH ATLANTIC GROUP.						
Maine	64,309	59,804	7.5	6,552,578	5,838,058	12.2
New Hampshire	32,181	29,642	8.6	3,721,173	3,605,994	3.2
Vermont	35 522	33,827	5.0	4,882,588	4,528,804	7.8
Massachusetts	38,406	26,500	44.9	3,359,079	2,730,283	23.0
Rhode Island	6,216	5,368	15.8	514,813	502,308	2.5
Connecticut	30,598	25,508	20.0	2,453,541	2,364,416	3.8
New York	241,058	216,253	11.5	23,780,754	22,190,810	7.2
New Jersey	34,307	30,652	11.9	2,929,773	2,989,511	*2.0
Pennsylvania	213,542	174,041	22.7	19,791,341	17,994,200	10.0
The group	696,139	601,595	15.7	67,985,640	62,744,384	8.4
SOUTH ATLANTIC GROUP.						
Delaware	8,749	7,615	14.9	1,090,245	1,052,322	3.6
Maryland	40,517	27,000	50.1	5.119,831	4,512,579	13.5
District of Columbia	435	209	108.1	18,146	11,677	55.4
Virginia	118,517	73,849	60.5	19,835,785	18,145,911	9.3
West Virginia	62,674	39,778	57.6	10,193,779	8,528,394	19.5
North Carolina	157,609	93,565	68.4	22,363,558	19,835,410	12.7
South Carolina	93,864	51,889	80.9	13,457.613	12,105,280	11.2
Georgia	138,626	69,956	98.2	26,043,282	23,647,941	10.1
Florida	23,438	10,241	128.9	3,297,324	2,373,541	38.9
The group	644,429	374,102	72.3	101,419,563	90,213,055	12.4
NORTHERN CENTRAL GROUP.						
Ohio	247,189	195,953	26.1	24,529.226	21,712,420	13.0
Indiana	194,013	161,289	20.3	20,420,983	18,119,648	12.7
Illinois	255,741	202,803	26.1	31,673,645	25,882,861	22.4
Michigan	154,008	98,786	55.9	13,807,240	10,019,142	37.8
Wisconsin	134,322	102,904	30.5	15,353,118	11,715,321	31.1
Minnesota	92,386	46,500	98.7	13,403,019	6,483,828	106.7
Iowa	185,351	116,292	59.4	24,752,700	15,541,793	59.3
Missouri	215,575	148,328	45.3	27,879,276	21,707,220	28.4
Dakota	17,435	1,720	913.7	3,800,656	302,376	1,156.9
Nebraska	63,387	12,301	415.3	9,944,826	2,073,781	379.6
Kansas	138,561	38,202	262.7	21,417,468	5,656,879	278.6
The group	1,697,968	1,125,078	50.9	206,982,157	139,215,269	48.7
SOUTHERN CENTRAL GROUP.						
Kentucky	166,453	118,422	40.6	21,495,240	18,660,106	15.2
Tennessee	165,650	118,141	40.2	20,666,915	19,581,214	5.5
Alabama	135,864	67,382	101.6	18,855,334	14,961,178	26.0
Mississippi	101,772	68,023	49.6	15,855,462	13,121,113	20.8
Louisiana	48,292	28,481	69.6	8,273,506	7,025,817	17.8
Texas	174,184	61,125	185.0	36,292,219	18,396,523	97.3
Arkansas	94,433	49,424	91.1	12,061,547	7,597,296	58.8
The group	886,648	510,998	73.5	133,500,223	99,343,247	34.4

* Decrease.

Increase in area and number of farms—Continued.

States and Territories.	Number of farms. 1880.	Number of farms. 1870.	Per cent. increase.	Acres in farms. 1880.	Acres in farms. 1870.	Per cent. increase.
WESTERN GROUP.						
Montana	1,519	851	78.5	405,683	139,537	190.7
Wyoming	457	175	161.1	124,433	4,341	2,766.5
Colorado	4,506	1,738	159.3	1,165,373	320,346	263.8
New Mexico	5,053	4,480	12.8	631,131	833,549	*24.3
Arizona	767	172	345.9	135,573	21,807	521.7
Utah	9,452	4,908	92.6	655,524	148,361	341.8
Nevada	1,404	1,036	35.5	530,862	208,510	154.6
Idaho	1,885	414	355.3	327,798	77,139	324.9
Washington	6,529	3,127	108.8	1,409,421	649,139	117.1
Oregon	16,217	7,587	113.7	4,214,712	2,389,252	76.4
California	35,934	23,724	51.5	16,593,742	11,427,105	45.2
The group	83,723	48,212	73.7	26,194,252	16,219,086	61.5

* Decrease.

SORGHUM.

It is now nearly thirty years since the introduction of this plant into the United States by the agricultural division of the Patent Office, which was the embryo of the Department of Agriculture. Its juice was said to contain from 10 to 16 per cent. of sugar, and it was claimed to be valuable for sugar, sirup, alcohol, and for forage. It was assumed that it would grow successfully in any part of the United States in which corn would thrive. For forage purposes it was deemed useful in the northern portion of the corn belt. The necessity of regarding climate in the quest for sugar was emphasized in the Agricultural Report of 1854 by quoting the test of Vilmorin of the "infinite superiority" of plants grown in Algeria over those grown near Paris.

Twenty-six years ago Dr. Charles T. Jackson made analyses both of ripe and unripe canes, and those of various degrees of ripeness, and from his experiments and researches declared himself "fully satisfied that both the Chinese and African varieties of sorghum will produce sugar of the cane type perfectly and abundantly *whenever the canes will ripen their seeds*." He expressed the hope that cultivators would not be discouraged, but continue the experiment, not only for the production of sirup, but for good crystallized sugar. He said that while unripe canes might be used for making molasses and alcohol, they would not yield true cane sugar. From nearly ripe African cane grown in Washington he calculated 16 per cent. of saccharine matter, and actually obtained 15.9 per cent.; and from a sample of Chinese cane fully ripe he obtained 16.6 per cent. His Massachusetts samples of unripe cane, taken September 16 and 18, gave about 10 per cent. of grape sugar.

Thus at the outset of the sorghum sugar experiment was fully established the fact of the large content of sugar, the requisite of ripeness for the full development of saccharine matter, and the excess of grape sugar in the unripe cane. Even the hindrance to sugar-making that has barred progress in all these subsequent years was hinted at—the inability of the small farmer to make sugar with crude appliances and the necessity of the full machinery of a well-equipped sugar-house and refinery. He foresaw the futility of sugar manufacture from small patches of cane, and foretold the necessity of extensive planting.

This frittering away of sugar possibilities in half-acre patches has been continued until the present time, with a few exceptions in the past two years. It was the cause of the failure of the Maine beet-sugar enter-

prise, in which minute areas were planted, drilled, and even sowed broadcast, and either cultivated or neglected by growers, many of whom knew nothing of the requisite culture, and insisted on the full rate of profit from their best crops as compensation for their apprenticeship to a new business. It is somewhat bewildering to listen to the European farmers wailing over American competition while growing beets at $4 per ton, and the answering wail of the American farmer at the receipt of $5 per ton for sugar beets.

From this early date to the present day analyses have been repeated by many chemists, showing a satisfactory content of sugar in the ripened cane; and sugar has been made in a small experimental way each year since 1854, though the amount has been trivial. Sirup has been made with a fair degree of success in the region in which maize attains a full development, while it has gone into disfavor even for that use in the territory north of the summer isothermal which passes through Philadelphia.

The tendency to granulation in the sirup of ripe cane was early taken advantage of for the saving of small samples of sugar. In 1862 the Ohio assessors reported 27,216 pounds of sugar and 30,872 acres of sorghum. It increased yearly to 67,068 pounds in 1865, when the area was 37,042 acres. In ten years the aggregate was 332,112 pounds of sugar, or an average a trifle above a pound per acre. The average product for fifteen years, from 1862 to 1876, was 32,423 pounds. Then came a sudden drop, and for five years, the identical period of exaggerated assertions and assumptions in relation to sorghum sugar, the average return was only 8,454 pounds. During the same period the acreage dropped from 16,104 to 7,930 acres. In Minnesota there is no official return of sugar until 1880, though there were small quantities which were included in equivalent of sirup. The aggregate for that year was 3,553 pounds, while the area returned was 6,914 acres. There was a return of 4,176 pounds in 1881 and 1,110 pounds in 1882.

In Kansas official records there is no mention of sugar until the present year.

The census of 1880 returns but 12,792 pounds of sugar made on farms in 1879. In fact, it was too rare and small a quantity to be taken into consideration after 29 years of cultivation. After 100 years of sorghum growing the same result would be seen if sugar depended on haphazard production on farms, as an accident rather than incident of sirup-making. Plainly the only hope for sorghum sugar is found in fully-equipped factories, with all the aid of the highest practical skill, scientific discovery, and American genius for obviating the disability of high-priced labor by economic processes.

SORGHUM IN THE CENSUS.

The gradual, slow, uneven progress of sorghum is seen in the last three census enumerations. In 1860 the distribution of area was quite general—rather small in the South except in Tennessee, and more general in Ohio, Indiana, Illinois, Iowa, and Missouri, these central corn-growing States producing much more than half of all the sirup in the country. As in the case of other exceptional and scattered crops some allowance must be made for omissions. There were probably 8,000,000 gallons made in 1859. In 1860 there was found a general enlargement of area, especially in the South.

The census was somewhat incomplete in 1870 in the South, even in returns of cotton, and an allowance of 15 or 20 per cent. should be made for that region, and probably 5 to 10 in the North. There were prob-

ably nearly 18,000,000 gallons produced in the United States. The census of 1880, for the year 1879, is doubtless substantially correct, making 28,444,202 gallons. In 1883 the product may have reached 30,000,000, though this is not a year of average summer temperature.

The census exhibit of sirup production is as follows:

States and Territories.	1860.	1870.	1880.
Massachusetts	....	....	18
Rhode Island	20	20	....
Connecticut	395	6, 832	1, 163
New York	516	7, 832	1, 134
New Jersey	396	17, 424	1, 261
Pennsylvania	22, 749	213, 373	69, 767
Delaware	1, 613	65, 908	25, 136
Maryland	907	28, 563	10, 837
Virginia	221, 270	329, 155	564, 558
North Carolina	263, 475	621, 855	964, 662
South Carolina	51, 041	183, 585	281, 242
Georgia	103, 490	374, 027	981, 152
Florida	....	....	10, 199
Alabama	55, 653	267, 269	1, 163, 451
Mississippi	1, 427	67, 509	1, 062, 140
Louisiana	....	180	33, 777
Texas	112, 412	174, 509	432, 059
Arkansas	115, 604	147, 203	1, 118, 364
Tennessee	706, 663	1, 254, 701	3, 776, 212
West Virginia	....	780, 829	817, 168
Kentucky	356, 705	1, 740, 453	2, 962, 965
Ohio	779, 076	2, 023, 427	1, 229, 852
Michigan	86, 953	94, 680	102, 500
Indiana	881, 049	2, 026, 212	1, 741, 853
Illinois	806, 589	1, 960, 473	2, 265, 993
Wisconsin	19, 854	74, 478	314, 150
Minnesota	14, 178	38, 725	543, 369
Iowa	1, 211, 512	1, 218, 636	2, 064, 020
Missouri	796, 111	1, 730, 171	4, 129, 595
Kansas	87, 656	449, 409	1, 429, 476
Nebraska	23, 497	77, 598	246, 047
California	552	333	2, 459
Oregon	315	....	2, 283
Nevada	....	3, 651	350
Colorado	....	....	3, 227
Arizona	....	....	5, 771
Dakota	20	1, 230	17, 012
Idaho	....	....	36
New Mexico	1, 950	1, 765	251
Utah	25, 475	67, 446	58, 221
Washington	....	612	1, 472
Total	6, 749, 123	16, 050, 089	28, 444, 202

OHIO ASSESSORS' RETURNS.—The Ohio returns are less defective than those of some other States. In principal crops the deficiency is rarely more than 10 per cent. In sorghum, the sirup reported is less by one-fifth than in the United States census. From 1862 to 1871, inclusive, the record made is as follows:

Years.	Acres.	Sirup.	Yield per acre.	Sugar.
		Gallons.	*Gallons.*	*Pounds.*
1862	30, 872	2, 700. 071	87. 5	27, 216
1863	31, 255	2, 347, 578	75. 1	27, 359
1864	29, 392	2, 655, 332	90. 3	29, 542
1865	37, 042	3, 963, 751	107	67, 068
1866	43, 101	4, 696, 089	109	55, 147
1867	17, 804	1, 255, 866	70. 5	17, 804
1868	25, 258	2, 004, 055	79. 3	28, 668
1869	53, 317	1, 777, 100	33. 3	30, 353
1870	23, 450	2, 187, 673	93. 3	23, 450
1871	23, 072	1, 817, 042	78. 8	25, 505
Total	314, 563	25, 404, 557	80. 8	332, 112

Through the war period, when the premium on gold made molasses high, the area of sorghum was high, declining abruptly in 1867. In the year 1869 an exceptionally large area was covered, but the yield was very small, the season being very unpropitious—wet and backward in spring and cold in summer. The ten succeeding years, 1872 to 1881, witnessed a decline in the area and rate of yield, with only a shadow of sugar in the exhibit:

Years.	Acres.	Sirup.	Yield per acre.	Sugar.
		Gallons.	*Gallons.*	*Pounds.*
1872	12,932	968,130	74.9	34,599
1873	9,426	692,314	73.4	36,846
1874	12,108	912,316	75.3	35,910
1875	12,772	928,786	72.7	21,808
1876	15,929	1,185,235	74.4	25,074
1877	16,104	1,180,255	73.3	7,507
1878	16,305	1,273,048	78.1	11,909
1879	13,621	1,010,654	74.2	8,236
1880	11,632	869,975	74.8	7,386
1881	7,930	492,191	62.1	7,733
Total	128,759	9,512,904	73.9	197,008

The above shows that sorghum is unpopular in Ohio, and in danger of being discarded, unless it shall promise in the future something more than sirup.

INDIANA.—This State has only recently organized a system of crop returns. The area in sorghum is not given, but the gallons of sirup produced are thus stated:

	Gallons.
1878	1,094,342
1879	1,588,232
1880	939,020
1881	791,377

The figures for Indiana in the census are one-fourth larger. The same tendency to decline as in Ohio is shown between 1879 and 1882. As to sugar, Mr. Rinard, the State statistical agent, says that "very little, if any, is made." Acreage is not reported.

ILLINOIS.—The Illinois assessors report a reduction in area like that which occurred in Ohio and Indiana, which was doubtless a reaction from the failure to realize the extravagant expectations raised by injudicious enthusiasm for sugar production. The secretary of the Illinois department of agriculture, S. D. Fisher, reports that he has "no statistics of sugar made from sorghum," but adds, "the success of the sugar factory at Champaign will doubtless give an impetus to the industry in this State." The Illinois returns are as follows:

Years.	Acres.	Yield per acre.	Sirup.
		Gallons.	*Gallons.*
1877	19,335	63.5	1,227,164
1878	14,638	80.2	1,174,549
1879	17,883	73.2	1,309,400
1880	9,825	64.7	636,216
1881	8,263	55.3	456,714
1882	13,757	59.4	816,892
Total	83,701	67.1	5,620,935

This makes an average of 67 gallons to the acre. The average for 1881, 55.3 gallons, shows how the yield declines in an unfavorable year for corn.

MINNESOTA.—Beyond the Mississippi, where immigration has been rapid and the increase in cultivated area is wonderful, the sorghum area has been increased. The commissioner of statistics of Minnesota reports the following figures for sorghum:

Years.	Acres.	Sirup.	Yield per acre.	Sugar.
		Gallons.	*Gallons.*	*Pounds.*
1870	727	51,688	71.1	None reported.
1871	893	37,736	42.3	Do.
1872	859	78,095	90.9	Do.
1873	747	53,226	71.3	Do.
1874	1,146	69,595	60.7	Do.
1875	1,534	70,479	45.9	Do.
1876	1,695	72,489	42.8	Do.
1877	2,200	140,153	63.7	Do.
1878	3,207	329,660	102.8	Do.
1879	5,033	446,946	88.8	Do.
1880	6,914	662,837	95.9	3,553
1881	7,396	684,066	92.5	4,176
1882	6,192	509,634	62.3	1,110
Total	38,543	3,206,604	83.2	8,839

Mr. H. H. Young, statistical agent for Minnesota, writes as follows concerning the obstacles to sugar-making in the northern region, and the experiments yet to be made:

Up to 1874 the cane raised here was a common sorghum, that did not fully ripen in this climate, and the sirup made from it was quite disagreeable to the taste. In 1874 Mr. C. F. Miller succeeded in growing a variety called Early Amber, which ripened well, and, aided by Mr. Seth H. Kenney, he manufactured from it during that and two following years a fairly good sirup. In 1876 they succeeded in improving the quality by a refining process, and also manufactured a tolerably good quality of sugar. Their processes being made public were adopted by others, and better mills and apparatus were also introduced about this time, all of which tended to give the industry a boom, and during the three succeeding years there was a largely increased production of both sirup and sugar. In 1879 Capt. Russell Blakely, one of our prominent capitalists, anxious to inaugurate the industry for the good of the State, built an expensive mill and refinery at Faribault, which was not completed, however, in time for operation to its full capacity that year, as in the two that followed. The sugar and sirup made there were of excellent quality, and met with ready sale, but the neighboring farmers could not be induced to grow and deliver cane enough to keep the factory fully employed even during the short season allowed for the manufacturing, and the establishment was accordingly closed up on the expiration of the season of 1881. This, with other discouraging circumstances, led to a falling off in the acreage planted, and the cold summer of 1882, followed by a worse season and damaging early frosts this year, will no doubt lead to a further reduction in next year's planting. This industry has not so far been generally successful in Minnesota, but a movement is now on foot to introduce here the cultivation of sugar beets and the manufacture of sugar therefrom, and, as I am informed by a gentleman who is familiar with that industry, the machinery and apparatus, to a great extent, is also adapted to the manufacture of sorghum sirup, and it is proposed to combine the two; that is, to use the factory during September for the sorghum until the beets are ripe and fit for use in October.

The difficulty in obtaining a sufficient quantity of the raw material, which was foreshadowed by Dr. Jackson and experienced disastrously in every attempt made in this country to manufacture beet sugar, is repeated again in the above initiatory experiment in the manufacture of sugar from sorghum. It is a difficulty that will ever exist in industries not fully established, and can only be avoided by control of the cultivation by the manufacturers.

KANSAS.—This State has had an exceptional increase of cultivated area, in which the sorghum acreage has shared. The product of sirup is higher per acre than for any other State. The total quantity in 1879 is reported at 2,721,459 gallons, while the United States census reports

for the same year but 1,429,476 gallons. As in other States the census figures are uniformly greater than the State returns, this exceptional difference excites a suspicion of inflation for which there is no necessity in so productive and progressive a State. However, the State figures are as follows:

Years.	Acres.	Sirup.	Yield per acre.	Sugar.
		Gallons.	*Gallons.*	*Pounds.*
1874	14,103	912,125	64.7	....
1875	23,026	2,542,512	110.4	....
1876	15,714	1,732,475	110.3	....
1877	20,784	2,390,131	115	....
1878	20,292	2,333,566	115	....
1879	23,665	2,721,459	115	....
1880	32,945	3,787,535	115	....
1881	45,623	3,899,440	85.5	....
1882	68,678	6,181,020	90	....
1883	102,042	5,000,000	49	*600,000
Total	366,877	31,500,263	85.9	600,000

* Estimate.

Mr. James M. McFarland, the statistical agent, explains that the large increase in 1883 was not for sirup or sugar, but for forage purposes, "at least 50,000 acres being devoted to the growing of the plant for that purpose" in the western part of the State, where it is found to endure drought better than corn. He says:

Sugar has been made this year from sorghum for the first time in the history of the State, its manufacture being confined to two points, Hutchinson and Sterling. The works at these two places are now in perfect working order, and are running up to their full capacity. Of sugar manufactured at Hutchinson and Sterling 90,000 pounds have been disposed of to refineries in Saint Louis, and the remainder of the 600,000 pounds is, I understand, under contract to Eastern houses. Great preparations are being made for next year, and it is the universal belief that the production of 1884 will be very large. Both establishments are contemplating the erection of refineries in connection with their works. The State board of agriculture estimates that there are from 2,000 to 2,500 manufactories, large and small, in the State where sirup is made from sorghum. Many of these will attempt the manufacture of sugar next year.

VALUE OF THE CROP.

What is the value of the sorghum crop? It cannot be denied that the plant has been an acquisition to America, and that it has qualities which will enable it to maintain its existence in the list of permanent crops in American agriculture. It is probably the most valuable of the list of plants introduced by the Department of Agriculture. It cannot be said that it has grown into great prominence. The increase in the area of corn in 1883 has been at least equal to five times the existing breadth of sorghum. There must yet be material increase before the latter occupies 1 per cent. of the area of maize. But it has already attained a greater annual value than buckwheat. It is worth nearly as much as the rye crop, and more than a third of the value of the barley product. The present acerage is principally used for sirup, which may be valued at 36 cents per gallon, and held to be worth about $10,000,000. Possibly 5,000,000 bushels of seed may be utilized, mostly in sections where corn is cheap, worth not over 30 cents per bushel, or $1,500,000. It is not extensively used for forage except in limited locations, and $1,500,000 may more than cover that item. The sugar is as yet a small figure in the account. The entire value of the crop may be roughly estimated at $13,000,000 without a probability of any considerable departure from the actual value.

Its future will largely depend on the success of the sugar experiment. Commercial sugar comes almost equally from the cane and the beet. The latter has been a development of Europe, the congenial home of roots, during the present century. The former is fairly successful on our Southern border. The beet may yet be produced on our Northern border, in regions of reliable summer rainfall and suitably low temperature. There is a vast area between—the home of Indian corn—where sorghum matures and develops a large content of sucrose. The only contingent of success in obtaining crystallized sugar is an economic one—a question of the cost of labor in growing and manufacturing. In twenty-five years the people of the United States will require 4,000,000,000 pounds of sugar annually, nearly half the present commercial product of the cane and the beet; and the demand will increase the price, so that it is probable that in the future, if not immediately, the sugar of the United States will be produced within the national borders, of cane, sorghum, or beet, and probably of all three combined.

If anything shall prevent an early consummation so much desired it will probably be the current exaggeration which makes sorghum a "bonanza," expectations extravagantly raised that cannot possibly be realized, and losses incurred through faith in visionary schemes. Theorists must give place to practical men, backed by abundant dollars.

AMERICAN COMPETITION WITH EUROPEAN AGRICULTURE.

The diminished production of European agriculture during the past ten years, and an increase of population in the same period, have caused enlarged demands upon the surplus bread and meat products of other continents. The reduction of the home supply has resulted from unfavorable seasons rather than any extensive loss of area in cultivation. In Great Britain the discouragement of continued failure has somewhat circumscribed the wheat area. These losses have fallen mainly on the agriculture of Western Europe.

While bad seasons were followed by worse in Europe, a series of exceptionally productive years was enjoyed in this country. A surplus of food products, always large, therefore became still larger, and a prominent share in the required supply was furnished by the United States. At the same time our railway transportation rates were wisely reduced to render possible this increased movement. The result was an unusual foreign export of wheat, corn, and meats, sold at lower rates than European farmers could afford to accept, when their operations became unprofitable, profits were absorbed, capital wasted, and in many cases bankruptcy followed. Rents declined and leases were given up.

For years the pressure of this hardship has borne heavily upon European agriculture; discontent has increased and remedies have been sought in a change of cropping, scientific and mechanical aids to production, in Government assistance and protection. But improvement has been slow in coming. Almost the first crumb of comfort to the foreign farmer was the disaster to American crops in 1881. This revived the hope that the ability of the United States to produce an unlimited surplus was overstated.

A royal commission was appointed in Great Britain in 1879 to consider the question of agricultural distress, which has continued its work from year to year, and sent commissions to this country, whose reports have been at intervals made public. There has been much talk of this distress and its causes, a little unwilling reduction of rents, and a wait-

ing for hoped-for amelioration from natural causes and the swing of events.

The foreign farmer is still anxious to know whether the United States can continue, with a rapid increase in population to be fed, this cheap supply of the food requirements of Europe. This immigration adds to the number of our farmers, and so tends to increase the supply; yet the proportion of farmers to those in other occupations is gradually becoming less, and will continue to decrease unless causes tending to break down other industries should intervene and crowd the ranks of agricultural laborers. The proportion of agriculturists among the occupations was 47.35 per cent. in 1870 and 44.10 in 1880. When it shall be still less, agriculture will be more remunerative than at present. In those States in which the proportion of farmers is least their annual income is highest, and *vice versa*.

The intelligent American farmer understands that the domestic demand is immeasurably of more importance to him than the foreign. Even during this era of heavy exportation of the raw products of agriculture, the home consumption of cereals has been 90 per cent. of the entire production. Meats, more concentrated products, will better bear exportation, and may be shipped abroad when grain shipments may be unprofitable. The extension of wheat-fields westward will enable producers to export wheat for many years to come, if prices should be high enough to afford a profit, but in the form of flour, to retain the milling profit, rather than as crude grain. Cheese will continue to be sent abroad largely, and butter might be if a larger proportion of "gilt-edged" should be produced and means provided for keeping it in perfect condition.

The constant improvement in implements, and the gradual advance in progressive methods in the older States, tends to increase the rate of yield of wheat, while the extension of the culture in the new lands leads towards reduction. It is a mistake to suppose that the larger part of our wheat is grown beyond the Mississippi, or that the heaviest yields are in the new lands, or that spring wheat will ever exceed in quantity the winter wheat of the United States. Spring wheat takes the lead in pioneer farming, and declines inevitably as systematic farming comes in, at least in all localities in which soil and climate favor fall or winter sowing.

In short, the farmers of the United States are not anxious to gain or to perpetuate the reputation of furnishing breadstuffs cheaper than any other civilized nation, though doubtless they can do it if they try.

German and French farmers, as well as British, have been for some years feeling the pressure of this competition. The city and country press of those countries has teemed with discussions of the situation, and writers on national and political economy have treated the subject at length in pamphlets and serials. A collection of this matter has been made. It has been examined with some care, and salient points in it have been sought, and translations made by the Department. A digest of this matter, as brief as it could well be made, with extracts, is presented in the following pages. There will be found much food for thought by the intelligent American farmer in the article, though it is necessarily fragmentary and incomplete, as a treatment of the great questions of rural and national economy involved in the subject of American competition with European agriculture.

To show the progress made in exportation of products of agriculture in a half century or more, the following figures from the records of the Bureau of Statistics are given:

Year ended June 30—	Value of exports of domestic merchandise.	Value of exports of products of domestic agriculture.	Per cent. of products of agriculture.
	Dollars.	*Dollars.*	
1820 *	51,683,640	41,657,673	80.60
1830 *	58,524,878	48,095,184	82.18
1840 *	111,660,561	92,548,067	82.93
1850	134,900,233	108,605,713	80.51
1860	316,242,423	256,560,972	81.14
1870	455,208,341	361,188,483	79.34
1880	823,946,353	683,010,976	82.90
1881	883,925,947	729,650,016	82.55
1882	733,239,732	552,219,819	75.31

* Year ended September 30.

The increase in number of farms, in improved (or tillable) acres, and in the total area of land in farms is thus shown from the records of the national census:

Years.	Number of farms.	Improved.	Total.
		Acres.	*Acres.*
1850	1,449,073	113,032,614	293,560,614
1860	2,044,077	163,110,720	407,212,538
1870	2,659,985	188,921,099	407,735,041
1880	4,008,907	284,771,042	536,081,835

The product of corn is nearly three times as much as in 1849, while the wheat aggregate is more than four times as large. The progress in grain-gowing has entirely outstripped the advance in population. It is shown from the census exhibits as follows, though it should be remembered that the corn crop in 1869 was a comparative failure, 25 per cent. less than the acreage would have yielded in a good year:

Years.	Corn.	Wheat.
	Bushels.	*Bushels.*
1849	592,071,104	100,485,944
1859	838,792,742	173,104,924
1869	760,944,549	287,745,626
1879	1,754,591,676	459,483,137

The nations most affected by competitive exportation from the United States are Great Britain, France, and Germany. To show the principal American exports to those nations, the following tables have been prepared from Reports of Commerce and Navigation, excluding the minor articles, which might extend the list without enlarging much the volume of quantity or value.

In the past ten years the exports to France have averaged $58,457,124, a trifle more than the imports. The exports to Germany have averaged $57,713,236; thei mports, $44,526,702. Great Britain and Ireland (the "United Kingdom") have been the best customers, buying annually to the value of $374,088,360, and sending in return to the United States

goods worth $160,627,212, showing a difference of over $213,000,000 per annum.

An examination of the details of this trade will illustrate the bearing of competition upon the agriculture of these countries:

Years.	Value of all exports.			Value of all imports.		
	Great Britain and Ireland.	France.	Germany.	Great Britain and Ireland.	France.	Germany.
1873	$316, 861, 874	$33, 781, 506	$61, 590, 047	$237, 298, 218	$33, 977, 200	$61, 401, 756
1874	345, 359, 584	42, 964, 311	62, 993, 225	180, 042, 813	51, 691, 896	43, 909, 852
1875	317, 111, 142	33, 632, 727	50, 466, 025	155, 297, 944	59, 773, 148	40, 247, 712
1876	336, 052, 050	39, 792, 702	50, 629, 072	123, 373, 281	50, 959, 577	35, 319, 462
1877	345, 961, 055	45, 139, 918	58, 107, 433	113, 734, 258	47, 556, 292	32, 509, 365
1878	387, 430, 730	55, 319, 138	54, 809, 845	107, 290, 677	43, 378, 870	34, 790, 103
1879	348, 828, 439	89, 669, 627	57, 057, 245	108, 538, 812	50, 684, 601	35, 519, 818
1880	453, 796, 497	100, 063, 044	57, 062, 263	210, 613, 694	69, 344, 412	52, 211, 237
1881	481, 135, 078	94, 197, 451	70, 188, 252	174, 493, 738	69, 806, 375	52, 989, 181
1882	408, 347, 155	50, 010, 818	54, 228, 953	195, 588, 692	88, 897, 606	56, 368, 542
Total	3, 740, 883, 604	584, 571, 242	577, 132, 360	1, 606, 272, 127	566, 069, 977	45, 267, 028

Exports of farm and forest products, agricultural implements, &c., for the years ending June 30, 1879, 1880, 1881, and 1882.

TO GREAT BRITAIN.

Articles.	1879.		1880.		1881.		1882.	
	Quantities.	Values.	Quantities.	Values.	Quantities.	Values.	Quantities.	Values.
Agricultural implements:								
Mowers and reapers .... number..	3, 561	$294, 946	2, 403	$247, 474	2, 899	$274, 800	2, 985	$264, 740
Plows and cultivators .... do....	19	174	35	475	97	1, 325	438	3, 549
All other agricultural implements .... do....	....	316, 130	....	252, 241	....	405, 470	....	280, 725
Animals, living:								
Hogs .... number..	25, 033	239, 484	10, 399	95, 151	15, 090	144, 230	995	9, 820
Horned cattle .... do....	71, 794	6, 616, 114	125, 517	11, 830, 292	134, 061	12, 973, 033	68, 008	6, 960, 600
Horses .... do....	1, 683	410, 420	788	340, 732	583	179, 675	353	151, 071
Mules .... do....	105	10, 750	359	27, 400	22	2, 750	....	....
Sheep .... do....	108, 652	887, 701	80, 501	702, 829	60, 608	595, 638	46, 228	435, 186
All other, and fowls .... do....	....	3, 327	....	810	....	1, 340	....	2, 508
Bark for tanning	....	63, 304	....	118, 080	....	63, 857	....	47, 368
Beer, ale, and porter in casks .... gallons..	6, 258	1, 300	414	127	67, 278	10, 040	383	140
Bones and bone dust .... cwts..	17, 659	35, 804	6, 432	14, 964	6, 951	23, 644	7, 930	16, 738
Bread and breadstuffs:								
Barley .... bushels..	176, 132	107, 416	547, 054	427, 336	753, 941	488, 536	100, 084	74, 950
Bread and biscuit .... pounds..	6, 599	429	3, 865	246	1, 773	199	8, 063	784
Indian corn .... bushels..	40, 278, 394	19, 490, 631	30, 064, 440	16, 785, 942	33, 513, 021	19, 185, 963	21, 754, 661	15, 009, 424
Indian corn meal .... barrels..	4, 808	13, 523	10, 765	30, 713	8, 879	26, 551	1, 070	3, 926
Oats .... bushels..	123, 516	44, 011	44, 222	16, 683	1, 660	680	8, 987	3, 988
Rye .... do....	69, 674	44, 979	173, 740	125, 005	55, 707	55, 232	26, 237	27, 548
Wheat .... do....	32, 083, 890	33, 950, 645	40, 824, 147	51, 229, 545	48, 729, 040	55, 387, 445	32, 224, 367	40, 875, 987
Wheat flour .... barrels..	2, 566, 533	13, 621, 105	3, 540, 124	20, 485, 105	4, 456, 138	25, 793, 123	3, 204, 623	19, 421, 421
Other small grain and pulse	....	218, 786	....	398, 679	....	158, 701	....	136, 832
Farina and other preparations of breadstuffs	....	1, 411, 184	....	2, 090, 587	....	1, 053, 967	....	285, 447
Cotton, and manufactures of:								
Sea island .... pounds..	3, 229, 837	882, 154	4, 014, 826	1, 321, 693	5, 860, 649	1, 743, 620	4, 126, 927	1, 174, 023
Other unmanufactured .... do	963, 088, 196	96, 101, 172	1, 189, 017, 239	136, 893, 824	1, 344, 044, 143	151, 630, 810	1, 156, 834, 667	132, 502, 345
Colored .... yards..	8, 851, 512	701, 073	6, 091, 998	471, 914	3, 093, 864	262, 842	2, 574, 266	204, 232
Uncolored .... do....	22, 567, 249	1, 683, 992	32, 896, 360	2, 712, 646	23, 595, 621	1, 888, 924	18, 441, 887	1, 587, 826
All other manufactures of	....	329, 069	....	336, 378	....	232, 158	....	240, 299
Fruits:								
Apples, dried .... pounds..	275, 829	13, 274	818, 780	53, 261	1, 635, 828	128, 753	473, 901	49, 454
Apples, green or ripe .... bushels..	1, 061, 301	797, 153	1, 031, 942	1, 101, 623	2, 866, 077	2, 145, 965	417, 517	460, 162
Other fruit, green, ripe, or dried	....	28, 565	....	60, 559	....	76, 045	....	55, 159
Preserved in cans or otherwise	....	154, 286	....	245, 464	....	241, 746	....	252, 679
Ginseng .... pounds..	24, 948	31, 124	20, 067	29, 315	13, 771	25, 237	1, 151	2, 259
Glue .... do....	100, 894	10, 799	43, 736	5, 013	41, 562	5, 777	5, 283	788

Hair:								
Unmanufactured	....	207, 450	....	166, 595	....	206, 158	....	173, 429
Manufactures of	....	6, 922	....	11, 365	....	20, 274	....	17, 882
Hay ... tons..	1, 024	16, 961	4, 816	78, 506	3, 605	72, 346	3, 480	68, 399
Hops ... pounds..	5, 156, 818	666, 993	9, 433, 239	2, 504, 156	8, 704, 385	1, 965, 674	5, 407, 569	1, 371, 435
Leather, and manufactures of:								
Morocco and other fine	....	765, 103	....	440, 399	....	537, 806	....	568, 173
Sole, upper, and all other ... pounds..	18, 669, 743	3, 609, 679	16, 667, 052	3, 877, 510	23, 043, 967	5, 135, 125	27, 870, 497	5, 656, 386
Boots and shoes ... pairs..	1, 936	2, 644	1, 134	1, 723	2, 237	811	4, 720	5, 852
Saddlery and harness	....	2, 004	....	3, 058	....	7, 823	....	3, 801
All other manufactures	....	108, 597	....	91, 272	....	124, 655	....	190, 405
Manures; substances used for	....	786, 785	....	315, 535	....	371, 338	....	627, 678
Naval stores:								
Rosin and terpentine ... barrels..	386, 830	810, 888	437, 686	1, 127, 586	423, 269	1, 120, 584	423, 296	1, 241, 327
Tar and pitch ... do	26, 040	39, 964	12, 965	20, 263	15, 110	30, 785	15, 816	35, 867
Oil-cake ... pounds..	277, 876, 700	3, 645, 221	385, 352, 898	5, 418, 906	374, 572, 221	5, 306, 411	337, 650, 148	5, 184, 239
Oils:								
Lard ... gallons..	1, 305, 766	675, 197	890, 835	476, 250	345, 793	218, 915	215, 789	184, 853
Neat's-foot and other animal ... do....	118, 682	113, 156	24, 406	18, 478	56, 456	42, 690	19, 793	15, 009
Cotton-seed ... do....	557, 785	230, 117	264, 083	109, 084	134, 556	54, 206	163, 485	73, 536
Linseed ... do....	479	296	650	380	3, 032	1, 780	1, 710	1, 050
Volatile or essential ... do....	....	155, 145	....	97, 856	....	19, 690	....	82, 831
Provisions:								
Bacon ... pounds..	....	....	....	....	471, 219, 294	38, 636, 198	384, 103, 110	38, 318, 699
Hams ... do....	516, 704, 581	38, 529, 183	554, 198, 333	37, 687, 069	57, 547, 415	5, 847, 815	30, 936, 586	3, 516, 799
Beef, fresh ... do....	52, 792, 969	4, 776, 572	84, 454, 881	7, 425, 255	103, 352, 477	9, 652, 568	65, 372, 941	6, 329, 449
Beef, salted or cured ... do....	21, 987, 162	1, 428, 873	29, 563, 101	1, 891, 438	27, 011, 777	1, 785, 558	33, 627, 843	2, 963, 767
Butter ... do....	24, 841, 714	3, 727, 965	27, 887, 893	4, 903, 848	23, 491, 810	4, 700, 924	8, 683, 420	1, 685, 572
Cheese ... do....	136, 600, 368	12, 122, 099	122, 125, 332	11, 687, 877	141, 015, 095	15, 589, 390	121, 904, 755	13, 369, 308
Condensed milk	....	24, 915	....	38, 633	....	48, 669	....	90, 681
Fish	....	1, 847, 326	....	1, 503, 349	....	1, 715, 357	....	2, 191, 804
Lard ... pounds..	89, 248, 313	6, 231, 777	112, 532, 702	8, 332, 824	114, 392, 387	10, 773, 781	80, 517, 164	9, 407, 757
Meats, preserved	....	6, 251, 051	....	6, 593, 395	....	5, 082, 593	....	3, 453, 231
Mutton, fresh ... pounds..	1, 374, 913	117, 780	2, 332, 824	176, 058	3, 363, 075	257, 087	1, 348, 196	128, 960
Oysters	....	306, 941	....	366, 403	....	414, 584	....	372, 111
Pork ... pounds..	30, 764, 739	2, 030, 969	36, 987, 976	2, 542, 897	49, 012, 533	3, 812, 657	29, 025, 694	2, 469, 131
Potatoes ... bushels..	248	194	59, 266	46, 844	2, 286	3, 491	2, 175	3, 381
Other vegetables	....	3, 072	....	3, 797	....	639	....	42, 472
Vegetables, prepared or preserved	....	61, 734	....	84, 905	....	90, 718	....	128, 373
Rice ... pounds..	2, 975	206	6, 268	488	8, 731	550	2, 482	162
Seeds:								
Clover ... pounds..	....	....	10, 315, 920	938, 883	2, 980, 840	258, 313	5, 453, 926	498, 410
Cotton ... do....	16, 285, 938	139, 988	10, 913, 854	120, 891	11, 176, 997	142, 507	10, 697, 442	102, 508
Timothy, garden, and other	....	688, 953	....	19, 219	....	97, 866	....	688, 884
Spirits distilled from grain ... gallons..	97, 385	42, 225	49, 676	23, 533	117, 886	37, 288	32, 850	14, 890
Spirits of turpentine ... do....	3, 725, 296	985, 996	3, 888, 801	1, 100, 171	3, 752, 615	1, 327, 043	4, 534, 975	2, 116, 849
Starch ... pounds..	2, 072, 137	133, 823	1, 991, 976	97, 900	1, 373, 481	70, 725	1, 082, 400	62, 733
Tallow ... do....	44, 687, 853	3, 100, 548	60, 205, 693	4, 386, 853	51, 572, 437	3, 805, 454	35, 671, 355	2, 859, 395
Tobacco, and manufactures of:								
Leaf ... pounds..	65, 010, 286	7, 151, 958	33, 996, 136	3, 693, 729	44, 545, 345	5, 199, 698	35, 341, 604	4, 414, 931
Cigars ... M ..	94	2, 505	355	8, 548	296	10, 027	309	11, 151

Exports of farm and forest products, agricultural implements, &c., for the years ending June 30, 1879, 1880, 1881, and 1882—Continued.

TO FRANCE.

Articles.	1879.		1880.		1881.		1882.	
	Quantities.	Values.	Quantities.	Values.	Quantities.	Values.	Quantities.	Values.
Agricultural implements:								
Mowers and reapers .... number..	4,090	$412,680	3,017	$335,710	1,261	$119,305	2,080	$187,930
All other agricultural implements .... do...	....	220,102	....	167,302	....	182,644	....	169,781
Animals, living:								
Horned cattle .... number..	118	11,800	1,240	135,370	1,297	129,520	110	10,000
Horses .... do...	15	3,000	98	23,600	3	1,200	107	29,000
Sheep .... do...	950	9,500	675	5,450	650	6,500	....	....
Bark, for tanning	....	30,485	....	56,501	....	27,243	....	16,822
Beer, ale, and porter, in casks .... gallons..	60	14	....	....	....	....	50	15
Bones and bonedust .... cwts..	2,070	4,973	562	2,615	435	2,016	1,369	5,601
Bread and breadstuffs:								
Bread and biscuit .... pounds..	....	....	....	....	2,280	176	35	7
Indian corn .... bushels..	2,564,226	1,141,239	8,573,845	4,748,293	4,987,985	2,668,436	1,344,970	809,668
Indian corn meal .... barrels..	30	98	....	....	125	475	367	1,438
Oats .... bushels..	1,991,396	628,919	228,983	87,646	50,001	20,025	224,780	95,568
Rye .... do...	167,817	105,531	348,438	317,855	....	....	....	....
Wheat .... do...	42,147,558	46,691,216	43,601,291	55,268,075	29,440,418	34,213,213	11,225,848	13,773,236
Wheat flour .... barrels..	27,075	129,703	9,933	64,009	46,396	290,341	4,579	25,789
Other small grain and pulse	....	441	....	15,512	....	....	....	431
Farina and other preparations of breadstuffs used as food	....	1,180	....	4,243	....	2,522	....	9,568
Cotton and manufactures of:								
Sea island .... pounds..	800,391	225,918	1,014,226	348,814	1,277,702	417,587	726,510	224,228
Other, unmanufactured .... do...	196,187,714	18,848,459	178,832,051	20,519,874	275,649,104	30,599,209	166,044,167	18,323,929
Colored .... yards..	....	....	2,500	199	1,000	160	15,000	1,025
Uncolored .... do...	20,000	900	222,023	20,087	54,912	10,836	41,760	4,829
All other manufactures of	....	....	....	1,851	....	5,804	....	3,538
Fruits:								
Apples, dried .... pounds..	....	....	189,534	8,838	6,428,818	302,337	557,007	30,862
Apples, green or ripe .... bushels..	156	185	240	338	5,659	5,579	246	493
Other fruit, green, ripe, or dried	....	6,417	....	1,431	....	33,489	....	6,626
Preserved in cans or otherwise	....	23,336	....	8,058	....	3,116	....	2,080
Glue	....	....	150	18	....	....	620	119
Hair:								
Unmanufactured	....	34,824	....	38,286	....	31,318	....	19,832
Manufactures of	....	....	....	....	....	1,037	....	6,059
Hay .... tons..	....	....	159	2,735	132	2,756	1	15
Hops .... pounds..	....	....	48,188	6,075	....	....	....	....

Leather manufactures of:								
Leather								
Morocco and other fine		1,033		300				387
Sole, upper, and all other .... pounds	26,899	4,980	5,131	800	2,353	800	353	100
Manufactures of saddlery and harness		45		156		797		625
All other manufactures		599		2,606		510		322
Manures, substances used for		23,544		3,939		7,420		3,252
Naval stores:								
Rosin and turpentine .... barrels	29,889	61,666	18,213	37,010	29,067	68,089	14,980	39,111
Tar and pitch .... do			10	25	2,065	4,344	3,787	9,598
Oil-cake .... pounds	16,765	169	22,400	260	10,500	135	145,000	2,700
Oils:								
Lard .... gallons	337,407	178,271	341,728	177,472	171,112	109,656	68,746	59,021
Neat's-foot and other animal .... do	509	410	1,500	1,100				
Cotton-seed .... do	1,259,878	538,251	1,430,231	656,848	359,584	154,813	59,106	29,619
Linseed .... do	46	30			800	528		
Volatile or essential		14,661		13,507		11,228		13,419
Provisions:								
Bacon .... pounds	53,593,720	3,248,214	66,357,041	3,848,930	64,730,438	4,517,994	4,776,689	381,375
Hams .... do					3,375,449	337,938	573,622	64,344
Beef, salted or cured .... do	561,331	39,368	1,011,175	59,946	359,440	22,754	434,730	34,439
Butter .... do	61,815	9,749	446,693	65,611	311,427	61,920	28,041	5,616
Cheese .... do	27,273	2,460	42,427	3,887	21,566	2,168	9,632	1,064
Fish		69,364		29,083		23,714		7,474
Lard .... pounds	42,360,456	2,877,630	55,462,701	3,941,971	61,908,551	5,567,030	31,610,618	3,699,876
Meats, preserved		86,976		150,810		83,091		14,296
Oysters		236		3,302		2,878		1,113
Pork .... pounds	2,168,614	140,658	1,608,545	104,329	1,896,969	131,741	257,574	22,956
Potatoes .... bushels	241	243	467	460				
Other vegetables						29		
Vegetables, prepared or preserved		4,945		1,417		2,650		558
Rice .... pounds	47,983	3,580	52,049	3,956	49,364	3,413	36,520	2,967
Seeds:								
Cotton .... pounds			49,125	2,080	25	1	3,430	28
Clover .... do		157,772	1,081,766	85,431	400,886	29,754	6,566,877	579,642
Timothy, garden, and all other .... do				7,615		6,187		34,100
Spirits distilled from grain .... gallons	3,349,437	1,009,973	2,703,259	689,175	3,286,112	666,720	3,056,522	608,348
Spirits of turpentine .... do	77,650	19,962	2,300	644	361,268	141,657		
Starch .... pounds	98,745	3,988	2,125	80	448	18	18,253	800
Tallow .... do	18,923,453	1,296,210	10,776,901	701,920	15,627,390	1,026,619	3,428,644	255,750
Tobacco, and manufactures of:								
Leaf .... pounds	44,784,776	2,572,908	26,921,601	1,646,021	37,038,725	2,627,728	31,736,787	2,294,291
Cigars .... M			1	50	4	200	19	804
Snuff .... pounds							20	4
All other manufactures of		5,256		6,079		7,697		9,203
Wax (bees) .... pounds	2,094	595	8,264	1,933	413	80	4,846	1,020
Wine .... gallons	171	227	450	792	396	860	260	355

Exports of farm and forest products, agricultural implements, &c., for the years ending June 30, 1879, 1880, 1881, and 1882—Continued.

TO GERMANY.

Articles.	1879.		1880.		1881.		1882.	
	Quantities.	Values.	Quantities.	Values.	Quantities.	Values.	Quantities.	Values.
Agricultural implements:								
Mowers and reapers .... number..	934	$86,184	849	$94,822	402	$38,228	991	$83,834
Plows and cultivators .... do....	2	30	3	79	6	85	14	198
All other agricultural implements		212,557		206,208		196,499		148,438
Animals, living:								
Hogs .... number..			973	17,510	1,834	28,425	11	435
Horned cattle .... do....	1,330	116,860			207	16,800	6	700
Horses .... do....	1	350			1	2,000	1	500
All other, and fowls		565		100		3,895		3,070
Bark for tanning		31,156		26,362		18,080		13,167
Beer, ale, and porter in casks .... gallons..	225	70	120	35	298	83	1,153	310
Bones and bone dust .... cwts..	982	1,340	1,039	1,024	468	500		
Bread and breadstuffs:								
Barley .... bushels..	550	600	460	368				
Bread and biscuit .... pounds..	600	59	7,000	490	23,658	1,186	3,083	455
Indian corn .... bushels..	3,894,311	1,826,611	7,589,858	4,082,354	10,320,247	5,741,526	3,647,878	2,369,414
Indian corn meal .... barrels..	90	283			1,219	3,466	350	1,263
Oats .... bushels..	298	96					170	109
Rye .... do....	748,622	455,600	345,753	266,999	851,732	782,605	196,474	190,596
Wheat .... do....	422,242	470,692	1,223,279	1,386,625	3,029,232	3,515,267	480,600	617,953
Wheat flour .... barrels..	11,233	64,628	11,911	67,787	17,373	103,356	4,893	33,699
Other small grain and pulse		2,960		3,218		17,549		2,985
Farina, and other preparations of breadstuffs used as food		23,332		20,719		45,859		28,225
Cotton, and manufactures of:								
Sea island .... pounds..			32,582	13,393			155	45
Other unmanufactured .... do....	137,484,413	13,110,159	153,989,982	17,708,261	233,005,704	25,616,850	162,489,950	18,404,760
Colored .... yards..	43,497	3,470	175,516	16,763	146,160	9,691	558,708	34,627
Uncolored .... do....	1,661,103	131,314	1,662,625	128,141	1,377,589	147,743	511,044	74,037
All other manufactures of		56,879		26,125		11,377		57,101
Fruits:								
Apples, dried .... pounds..	3,289,096	125,048	1,282,631	78,618	8,174,002	469,650	361,505	32,229
Apples, green or ripe .... bushels..	5,653	7,164	5,888	10,008	69,573	53,941	2,702	4,549
Other fruit, green, ripe, or dried		3,162		3,402		22,284		7,242
Preserved, in cans or otherwise		31,367		16,733		25,376		19,929
Glue .... pounds..	71,200	8,704	6,595	989	13,220	2,390	14,919	2,946
Hair, unmanufactured		16,223		17,082		18,487		24,805

Hay .... tons..	......	......	......	......	......	......	66	1, 201
Hops .... pounds..	3, 523	457	7, 469	2, 350	4, 057	1, 075	......	......
Leather, and manufactures of leather:								
Morocco, and other fine	......	28, 639	......	15, 572	......	21, 236	......	10, 813
Sole, upper, and all other .... pounds..	7, 536, 200	1, 630, 721	3, 970, 742	914, 791	3, 659, 991	820, 925	2, 561, 447	545, 481
Manufactures of boots and shoes .... pairs..	1, 907	1, 972	1, 103	1, 465	44	65	96	75
Saddlery and harness	......	962	......	1, 060	......	1, 111	......	732
All other manufactures	......	114, 957	......	98, 557	......	64, 814	......	75, 192
Manures, substances used for	......	132, 430	......	164, 343	......	36, 909	......	98, 235
Naval stores:								
Rosin and turpentine .... barrels..	213, 239	350, 629	197, 795	366, 583	165, 326	359, 170	255, 627	663, 041
Oil-cake .... pounds..	389, 494	6, 323	3, 214, 817	38, 244	5, 282, 485	58, 576	41, 955, 868	525, 084
Oils:								
Lard .... gallons..	14, 490	8, 379	24, 149	14, 516	36, 655	24, 648	19, 342	15, 571
Neat's-foot, and other animal .... do....	690	597	600	460	48	55	48	64
Cotton-seed .... do....	1, 094	451	48	22	18, 095	8, 594	18, 707	9, 109
Linseed .... do....	......	......	......	......	120	80	......	......
Volatile or essential	......	69, 760	......	101, 407	......	55, 511	......	118, 028
Provisions:								
Bacon .... pounds..	37, 508, 897	2, 051, 712	26, 843, 862	1, 786, 494	39, 879, 444	2, 982, 852	3, 482, 623	295, 856
Hams .... do....					1, 670, 326	172, 655	397, 733	44, 024
Beef, salted or cured .... do....	2, 409, 670	147, 104	2, 516, 769	178, 182	2, 053, 104	140, 443	1, 938, 742	150, 065
Butter .... do....	8, 210, 578	884, 735	5, 349, 549	663, 720	1, 760, 197	279, 439	1, 264, 078	189, 040
Cheese .... do....	410, 827	33, 740	550, 281	45, 123	134, 100	11, 539	191, 651	14, 788
Condensed milk	......	1, 547	......	191	......	467	......	......
Fish	......	69, 450	......	71, 460	......	68, 410	......	64, 845
Lard .... pounds..	89, 710, 334	6, 163, 503	85, 509, 388	6, 379, 894	88, 127, 893	8, 018, 932	55, 467, 728	6, 255, 827
Meats, preserved	......	402, 999	......	389, 823	......	291, 846	......	179, 681
Oysters	......	27, 145	......	22, 709	......	26, 694	......	25, 192
Pork .... pounds..	919, 817	52, 281	1, 259, 417	79, 364	1, 455, 646	108, 218	1, 109, 000	92, 546
Other vegetables	......	3	......	2	......	200	......	483
Vegetables, prepared or preserved	......	3, 181	......	2, 567	......	2, 514	......	986
Rice .... pounds..	2, 524	192	2, 443	243	4, 135	305	8, 252	627
Seeds:								
Cotton .... pounds..	......	......	......	......	400, 000	3, 928	336, 000	2, 253
Clover .... do....	......	......	9, 216, 267	841, 210	1, 933, 555	171, 889	13, 938, 582	1, 282, 779
Timothy, garden, and all other	......	564, 826	......	7, 806	......	25, 707	......	45, 215
Spirits distilled from grain .... gallons..	122, 416	35, 868	410, 263	146, 429	592, 461	119, 584	140, 423	27, 795
Spirits of turpentine .... do....	606, 769	161, 609	643, 842	169, 121	298, 206	102, 717	650, 514	288, 624
Starch .... pounds..	3, 546, 214	152, 761	2, 668, 649	118, 650	2, 603, 091	127, 436	1, 366, 410	62, 577
Tallow .... do....	12, 008, 784	835, 277	11, 688, 328	749, 253	6, 980, 973	470, 735	249, 637	20, 214
Tobacco, and manufactures of:								
Leaf .... pounds..	112, 098, 952	8, 108, 819	59, 495, 964	4, 063, 898	48, 612, 197	3, 430, 250	52, 872, 239	3, 577, 622
Cigars .... M..	56	2, 479	58	1, 712	19	775	49	1, 890
Snuff .... pounds..	......	......	824	397	4, 644	2, 326	540	190
All other manufactures of	......	80, 518	......	78, 019	......	62, 599	......	69, 852
Wax (bees) .... pounds..	5, 464	1, 500	10, 083	1, 987	2, 980	803	1, 125	337
Wine .... gallons..	5, 799	5, 296	99, 227	69, 144	2, 360	3, 059	5, 635	5, 827

THE BRITISH COMMISSION REPORT.

In 1880 was issued the first report of the assistant commissioners, Messrs. Clare Sewell Read and Albert Pell, upon the elements of American competition, from observations and investigations made in this country in the autumn of 1879. They gave prominence to the spring-wheat section of the Northwest, hinting at its methods, and describing the mode of selling and delivering grain, and attempting to estimate the cost of cultivating an acre of wheat by operations which, "though the very reverse of barbarous, are simple in the extreme." They assumed as a fair average of this cost, including carriage six miles to a railroad station, ten dollars per acre. Of the cost per bushel they said: "The yield of wheat in the United States over a long series of years appears to have just exceeded 12 bushels per acre. For the year 1879 the yield is returned at 13.1 bushels. With a yield of 12 bushels the Western farmer could deliver from his wagon at the depot without loss at 3*s*. 6*d*. a bushel of 60 pounds, or 28*s*. a quarter of 480 pounds, which is 20 pounds short of the English weight of 5 centals. The normal price of wheat in America on the east coast will range not with the cost of production on the farms immediately surrounding the great centers of population and industry, but with the value of land, labor, and money in the new land of the West, plus the varying cost of inland freight. As it is true that the center of population and industrial employment in the United States is with certainty and rapidity moving westward, it is equally true that the cultivation of wheat is nomadic, and advances not in front of this movement, but in the same direction, and is regarded by the farmers as more profitable; in other words, cheaper when conducted on virgin soil at a distance from the points of consumption than in the exhausted districts from which they migrate and give place to a population for whom they have to find breadstuff. Any estimate, therefore, of the prime cost of American wheat in England will depend materially on the cost of supply from the West." The average cost of transportation from Chicago to New York, for five years, per quarter of eight bushels (480 pounds), they make 3*s*. 5*d*. by lake and canal, and 6*s*. 10*d*. by all rail; the ocean transportation, 4*s*. 9½*d*. per quarter.

The cattle industry is considered in this report mainly with reference to the great herds of the ranches on the plains and in the valleys of the Rocky Mountain system. The facts are fairly presented, usually with a good degree of judgment and appreciation of governing circumstances.

Two years later, Mr. John Clay, jr., a member of the Royal Commission on Agriculture, made a supplementary report. He had made a report on California, in 1881, in which, as a result of absorption of the inflated views of production prevailing in San Francisco commercial circles, he expressed the opinion that the official average of annual estimates for a period of years, viz, 12 bushels per acre for the whole country, was too low. The modesty of such an assumption, from a cursory glance at a few wheat fields, and casual talks with wheat buyers, is not altogether a unique exhibition, or unknown to American crop reporters of limited means of observation. But after the great depreciation in the yield of 1881, he changed his mind, and fixed the average at 12½ bushels, "a little above the official estimate." In the report of 1882, which evinces a knowledge of the factors of profitable agriculture, and an intelligent appreciation of the agricultural situation in this country, he takes a hopeful view of the effect of American competition, declines to believe that Western wheat can be laid down in Liverpool with profit

at $1.25 per bushel in the years of the future, and "has no hesitation in saying that its influence upon British agriculture has been exaggerated." He admits that pork can and will be produced more profitably here than in England, but holds that our cattle ranges are already crowded, and that the death-rate of the preceding winter resulted from this cause more than from the severity of the winter. He says of them:

We hear a great deal about the vast herds of the Western States, but when seen they are a miserable class of scalawags, an unthrifty race, and their effect upon British agriculture is small indeed.

Yet he admits they "fill up a gap," and "supply a certain class of the population, and allow the better class of the stock to be exported," and declares that there is an insatiable craving for a better quality of meat among the meat-eating races of the world, and to this cause is attributed the recent increase of prices.

A more thorough knowledge of the facts would have pointed out the reduction of the corn yield of 1881, following a winter of heavy losses of cattle in the Territories, as the most potent factors in the remarkable advance of 1881-'82. He says concerning the meat problem:

If the British farmer will not improve his stock and keep pace with the demand for better grades of all classes of beef and mutton, he will surely lose the day; but if he goes ahead and does all that lies in his power to maintain his reputation as *the* cattle raiser and feeder of the world, justly proud of his pre-eminent position, then he need not fear American competion so much. Almost boundless though the territory of the transatlantic stock raiser may be, we must ever remember that on the very best grazing lands of America it will take more than two acres to do the work of one at home; while out on the prairie, on the arid plains of Colorado and Wyoming, it will often require the grass product of 50 to 100 acres to keep an animal, while in good wild land it is estimated that a steer will need 10 to 15 acres to carry it through the year.

Relative to the claim of great profit in "bonanza wheat farming," he reports as follows:

He clears a fair return, but seldom makes a fortune. I know of large wheat farms on the prairies which, with all those stories of cheap production and great prices, have scarcely paid interest and expenses, instead of making their owners gigantic fortunes, as they should have done at the above figures. The evidence in California, where the most leviathan wheat farms in the world are met with, is conclusive, on this point and I venture to say that most of the large wheat farms on the prairie will eventually fail, as nearly all large farms have done in this country. There are men, of course, who can carry through gigantic operations of any kind, but the average result will be failure. If the American farmer can get no more than 40*s*. per quarter for his finest wheats in the Liverpool markets it will be a sad day for him. It is his only stronghold. The British farmer, when wheat fails him, has other strings to his bow. Our experience of farming is that the principal products of the farm, and more especially wheat, are delivered to the consumer at a little over cost of production.

AUSTRIA-HUNGARY.

The effect of American competition upon Austria-Hungary is considered in a pamphlet published in Vienna, entitled *Die Amerikanische Concurrenz*, by Dr. Alexander Peez, member of the Austrian Reichsrath.

He recognizes the fact that Great Britain is super-industrial; that her steady aim is superiority, if not supremacy, and the opening of all the markets of the world to the products of her manufacture. He hints at international protection against American and Russian competition and thinks Great Britain should have taken the initiative, and asked a reduction of the tariff upon manufactures in compensation for the privilege of exchanging free of excise the raw products of agriculture.

Instead of this, he remarks that British measures only were consid-

ered, and that the interests of other countries were disregarded; instead of this, a union of Great Britain and her dependencies was broached, to be protected by differential tariffs. The idea was to obtain breadstuffs and all raw material from the British Colonies.

The author has no doubt about the motives that prevented the adoption of this policy by Great Britain. He sees in cheap grain a stimulus to English manufactures—"a powerful means for fortifying her industries and commercial sovereignty." He declares it is the "regular Manchester policy," which is followed so closely by the ministry, to protect the manufacturing interest by low prices of bread that will render possible low wages of labor, and that hereafter England's wheat fields "will lie in America"; and that while the home grower of wheat is sacrificed a small concession is made to the agricultural interest in the protection of the more profitable branch of rural industry, meat production, by interdicting free trade in American meat through annoying restrictions upon its importation. He recalls the fact that British industries "grew up under the pressure of a wheat price of 60*s.* to 65*s.* per quarter," and has been sustained, since the era of free commercial competition, by reduction in the price of wheat and meats equivalent to an increase of 20 to 25 per cent. in the wages of English laborers.

Farmers in England have acquiesced in low prices for wheat and meats, and foreign farmers have accepted still lower prices, to sustain the policy of dominating the manufacture of the world and controlling its commercial distribution. "London, Liverpool, and Manchester," says the essayist, "which were once the dearest markets for food supplies, are now the cheapest in all Western and Central Europe." He recognizes the truth that competition with the industries of the world requires low rates of wages and prices of raw materials, and that American and Russian underselling of food products is strengthening British industries and increasing the competing power of their products in the markets of the world. He concludes that England rejoices in the fact of American competition in the wheat supply, and has "forged out of the great production of America a new weapon against the continental industries." He apprehends that the present pressure, assumed to be due to the prosperity of British industries, will soon be "more keenly felt by other European countries; that these industries will more fully monopolize the neutral markets; that English statecraft will in still greater degree be the tool of the industrial interests; that English commercial policy, quite in opposition to the proclaimed principle of 'laisser faire' will attempt still more obstinately to open all markets for itself and to crush out all competitors." He instances such interference with the trade of Austria-Hungary, and thinks the neighboring States must come to the conclusion that in their trade endeavors they "will meet with a rival who, while he raises the standard of free trade by Government action, shapes his commercial policy to an exceedingly selfish end."

He concludes that as America and Russia are independent of foreign markets, and Great Britain takes possession of the markets of the world, that France, Germany, Austria-Hungary, and smaller states should form a union to countervail these three great powers—a union for high foreign duties and low internal-revenue taxes. In fine, he arrives at the conclusion, in international economy, that the meat upon which Great Britain thrives may prove a poison to the Central European nations. The following extracts are from translations from his work on American competition:

The Austrian industrialists never have disclaimed their solidarity with the farmers of the monarchy. As early as 1864 the "Society of Austrian Industrialists" devoted

a series of papers entitled "Commercial Policy" to the relation of the industries to agriculture. It was an original work; for its motto was chosen an aphorism of the then Vice-President Colleredo Mannafeld: "Anything that brings a return of value is an industry."

This is a striking recognition of agriculture as the greatest branch of industry in Austria. Indeed, in no other country are the interests of agriculture and the industries so thoroughly identified with each other as in Austria-Hungary. Not only that the trade industries, as everywhere else, obtain the greater part of their raw materials from the farm, but in many cases the intimate relationship between agriculture and the industries is shown by the fact that one man devotes himself to the two kinds of pursuits. The manufacture of sugar, the milling industry, the distillers, the breweries, the malt industry, &c., are specimens of agricultural industries.

Any danger threatening Austro-Hungarian agriculture will likewise fill with concern the Austro-Hungarian industries, and therefore the latter must consult with the former about the best means to avert the danger, and lend a willing hand to apply them. The danger to which we allude is the competition resulting from the enormously increased raw production of the United States and Canada.

As early as 1873 small quantities of American wheat appeared in the markets and mills of Northern Bohemia. At the same time considerable quantities of lard and bacon came to us, and so great was the effect of even their first appearance that, while in 1870 Austria-Hungary exported 165,000 meter zentners of these articles, in 1874 150,000 meter zentners were imported, the American products having gone so far as Pesth. Since then Austrian commercial history further records the fact that in 1879 American wheat was sold in the markets of Trieste and Fiume, the export ports of the Hungarian grain trade; and that in 1880 the pressed yeast factories about Pilsen consumed about 30,000 meter zentners of American corn, while in Reichenberg American apples have become a staple market article.

If, hitherto, these shipments were but occasionally made, it may be explained by the fact that the products of American soil were principally sent to Western Europe, where, particularly in Great Britain, which country had been disappointed by repeated crop failures, they were sold at a paying price, and found an almost unlimited market. Feeling secure in consequence, we did not duly regard the first intimations of danger. In the mean time, however, American agricultural production has assumed so extensive proportions, and the American products have so fully established themselves in the markets of Western Europe, that the Americans have learned to know the advantages of so great an amount of exports, and have therefore made suitable preparations to this end; and it requires but little gift of prophecy to foretell that even crop failures in America can hardly permanently check the stream of shipments, now that it is started, and that when England, France, and the rest of Europe have good crops the pressure of American competition must become simply enormous, and this pressure will not only curtail the sales of Austro-Hungarian products abroad, but under certain circumstances will even become dangerous to our farming interests at home.

Whence this sudden competition? Why this giant growth of American exports? How is it that great distances have been overcome with such ease, thus making it possible for the crops of the New World to be poured out over Europe? Will these shipments be permanent? And what effect will they have upon the condition of agriculture in Europe, and particularly in Austria-Hungary?

PROSPECTIVE CONTINUANCE OF COMPETITION.

In the foregoing investigations we attempted to show that the ordinarily active hindrances to American agriculture—want of capital and labor—do no longer exist; the former has been completely removed by the rapid internal growth of capital, and the latter has been materially improved by the emigration from the eastern part of the United States to the western, by European immigration to the Union, by the general use of machinery, and by the custom of the proprietors of large farms to discharge their farm-hands at the first fall of snow.

On the other hand, American agriculture has to contend with several drawbacks which are a rarity in Europe, at least in the central and the western part of it. We will mention, for example, the depredations of the grasshoppers and other insects, which often destroy entire crops in the best wheat regions—Minnesota, Oregon, Iowa, and Missouri, even in Utah, Arizona, Nevada, Montana, Idaho, and Wyoming. The Northwest sometimes suffers from severe cold, the mercury often falling as low as 30 degrees and more in the shade. There all depends upon a timely fall of rain. In California and in the prairies there is a lack of good water; often a drought prevails, much to the detriment of stock-raising. These disadvantages cannot be denied, but as they have not hitherto hindered the phenomenal progress of agriculture, they will be controlled in the future. A statement, which is quite strange, but often met with, claims that the extension of railroads and their great increase in number have caused

a greater annual rainfall in the West, and that the frequent crop failures in England during the last decades are attributable to the attraction of rain, caused by the great number of railroads. More serious than any of the troubles mentioned above is the fact that the United States owes her condition to compete in Europe to certain limited sections of country which of late years have been given to the plow. Now, after the cream has been skimmed off these lands, the impetus of competition will become all the weaker, since America really practices exhaustive agriculture. It is said that one sees small armies equipped with horses and tools, and guided by the railroads, suddenly appear in the prairies; they encamp after the manner of nomads, plow the ground, sow, harvest, and ship their crops, discharge the greater part of their farm-hands at the beginning of winter, re-employ them at a more favorable time in the following year, and thus continue until the exhausted soil refuses to recover; this condition of affairs being but transitory.

This description is just only in so far as the large farms of the distant newly-settled West are concerned; certainly is it but natural that extensive (exhaustive) agriculture should obtain in regions just referred to. The exhaustion of the soil generally does not take place until after the expiration of a considerable length of time, this depending, of course, upon the quality of the soil. Often wheat is raised upon the same field for five, ten, yes, twenty and more years in succession. The interpolation of a change crop serves to lengthen the period. Frequently it is preferable to completely exhaust the soil and then to take up new land; that is, the field is changed, not the crop. It is a plan which, of course, cannot be measured by the standard of European agriculture, which is founded upon permanent conditions and works out permanent conditions. The statements as to the extent of the reserve land for such agricultural methods do not agree. We do not care to give their figures, but our opinion is that the Americans, for the purpose of making useful less favorable regions, have applied the requisite methods, and that there still are of this kind of land in both the United States and in Canada free areas which do not presage a speedy cessation of the heavy exports of grain. In the mean time, however, intensive farming is practiced by the sterling small farmers, and farming, as it is carried on in Illinois and generally in the older settlements of the Mississippi Valley, must not be confounded with the nomadic operations of the Northwest. In Illinois to-day there is a yield per acre of 0.9 meter zentner, which does not differ very much from the general average of 8.3 meter zentner per acre in England. Though a robbing culture (exhaustive culture) is carried on in parts of America, and though in others the proper care is not yet bestowed upon the means of replenishing the lost parts of the soil, yet we must expect that the commercial shrewdness, the energy, and the great capital of the Americans will suggest different methods as soon as that practiced hitherto becomes less profitable. The latter, we repeat it, is not the offspring of poverty and ignorance, but of cool calculation. Increasing population will, as it has done elsewhere, lead to more extensive farming, and in the continually increasing herds we see the mediators which will improve the soil and render possible and accomplish a transition to more intensive methods.

For the present, however, we can see nothing in the peculiar agricultural methods of the American which might within the next ten or twenty years (and further than this we need not now look ahead) cause a slackening of American competition abroad. When we consider that the Mississippi Valley, fruitful throughout, though thinly populated in the northern and eastern portions, is six times as large in area as France; when we learn that Texas, with a population of two millions, could produce enough bread and meat to supply the sixty-seven millions of population of Germany, England, and Wales, and Atkinson assures us that the United States have 200,000,000 of acres of land, or 81,000,000 hectares suitable for raising Indian corn, yielding over 5,000,000 bushels, or 1,275,000,000 meter zentner—that is, three times the present crop; furthermore, the profits of American agriculture are estimated by experienced men to be from 20 to 25 per cent., and if this is a confirmed proof of the high returns in the fiscal year ending June 30, 1880; 10,459 kilometers* of new railroads were built, and further, 22,500 kilometers were projected—then we cannot attach much importance to the objections mentioned above.

The crumbs of comfort Europe has derived from certain troubles in the system of transportation have likewise proved to be a delusion and a snare.

By the export of cereals, gains are made. These gains invite immigration and increase of population; thereby the number of domestic consumers in the United States is increased. This causes a decreasing percentage in the amount of grain set aside for exportation. Therefore, the equilibrium between America and Europe will inevitably be restored. All this is not only strictly logical, but it is incontrovertible; only no one can make anything out of the conclusion one is compelled to draw from such premises. In the mean time, we may all be dead and gone. The former "equilibrium" might still obtain, had it not been disturbed by the unphilosophical energy and trade

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* One kilometer = 0.6214 mile.

policy of the Americans; and even if we do not fortify ourselves with an approximatively similar energy, the equilibrium will sooner or later be again established—but without us, against us, and over the ruins of existing economic conditions, not to say of existing states and countries.

INTERNATIONAL PROTECTION.

Great Britain is superindustrial. Her commercial policy is simple, its object being the opening of all markets to the product of the English industries. In her policy she has not been altogether unfair, since she granted to other countries, too, the free market she demanded. Whether or not this feature is more ostensible than real, we shall not discuss here. We have shown above, in speaking of the restrictive measures adopted by England with regard to the importation of live stock from the Continent and from the United States, that the measures of British trade-policy are only so long in force as British interests are thereby furthered; yet is it undeniable that Great Britain has opened wide her ports for agricultural products, and thus has given the venders an opportunity to pay approximately at least for their purchases of English manufactures in agricultural products.

The other two great powers, on the contrary (Russia and the United States), have from the beginning taken a different stand. They force their way into commerce, flood Europe with farm products, and then close their markets to European manufactures. Europe would overlook a few bad features arising from the wholesale shipments from Russia and America, and receive with open arms their production, if the latter could only be paid for by European manufactures. The trouble, the injustice, lies in the want of reciprocity.

Under these circumstances, an international protection against American and Russian competition would have been in order, and the initiative ought to have been taken by England, the heaviest recipient. If she had united with the Central European States, and had asked of Russia and of the United States a reduction of their enormously high protection tariff, by way of compensation for allowing the crude products of those two countries to enter as heretofore, free of duty, or with a slight duty on them, then a demand like this might have been successfully entertained. Russia, owing to her critical condition, would hardly have resisted very long. But such an initiative was not taken. When protection against the commercial policy of Russia and America was spoken of, only British measures were thought of in England. The idea then was broached of making the United States, by a duty upon the productions of her soil, help to pay off the real estate indebtedness of Ireland; furthermore, a union of Great Britain and her dependencies was discussed, which was to be protected by differential tariffs. At a meeting held in June, 1881, Stanly Hill said: "We ought to import our grain, our breadstuffs, and everything that can be produced in our colonies, from these colonies only; and the latter ought to buy all the industrial wares they need from England, their mother country. Then America, France, and Russia will speedily enough drop their tariffs."

But all these propositions were not favorably received; and he who knows the commercial policy of England, and particularly that of the liberal ministry, cannot long be in doubt as to the motives.

If we examine these conditions and consider the peculiar position of the three leading economic powers—Russia and America being independent of foreign markets as far as the products of agriculture and of the industries are concerned, in fact shutting themselves off from the European industries while Great Britain looks up every market for manufactures in the world and takes possession of it for her fast-grown industries—it would seem important that France, Germany, Austria-Hungary, and the smaller states should, by means of a union, try to countervail those three great powers. They ought first to form among themselves a union with high foreign duties and low internal-revenue taxes, from this vantage-ground to treat with those powers for mutually free conditions.

This idea for forming a central European union is not a new one, but its execution lies wholly in the political field, and only a due appreciation on the part of the leaders or very great calamities will tend to remove the natural hindrances and opposition to this plan. The more distant, therefore, the time, the more's the pity. When international action takes place with regard to American competition, the more necessary is home protection by means of strengthening and concentrating all productive factors.

We come to the conclusion: It may be well or not, but the different states are more and more assuming the character of large corporative unions (not to say "business" corporations), for the purpose of securing the greatest possible share of earthly goods for all classes of society. The two great Anglo-Saxon states, of which one by the end of this century will have 100,000,000 population, and the other (with its colonies) over 300,000,000, are already beginning to steer into this channel, and are compelling by their competition other body-politics to follow their example. He that does not

wish to step back and be crushed, must keep up. Quiescence and romance are disappearing from the world. The old states of the Continent must appropriate a drop of the American blood. Cherished dreams and ancient prejudices are no longer tenable. How will the overburdened bear up in this cruel race-track? And will there be any room left for the support of national bickerings?

In the sixteenth century American competition ruined the mining industries of Europe, changed the direction of the world's commerce, brought about by the increased amount of precious metals a revolution in prices, transformed the social conditions, and prepared the terrible civil war of the seventeenth century—the thirty years' war. May the competition of America in the nineteenth century lead to more happy results. No doubt it is the greatest economic event of modern times. If it will prove a blessing or a curse depends upon the good judgment and energy with which the Governments and peoples of Europe will meet it.

A CRISIS IN GERMAN AGRICULTURE.

A pamphlet written by Max Wirth, and published at Berlin, entitled *Krisis in der Landwirthschaft und Mittel zur Hülfe*, admits that a crisis in agriculture has come, calling for prompt and radical measures of relief. The following quotations indicate fairly his views of the situation:

Agriculture is at present, so far as production of grain is concerned, in a crisis such as has not occurred in the history of husbandry since the introduction of steamships and railroads. From 1876 to 1879 Great Britain's crops were a succession of failures, and in the latter year a like calamity extended over the greater part of the European continent. In the United States, in consequence of an exodus-like movement of the working classes to the West and to the Northwest, every summer since 1876 shows a greatly increased acreage of grain. Aside from this the United States have been blessed since 1876 with uninterruptedly good crops, so that from year to year the increasing, enormous surplus of grain has been sent to Europe. This export during the winter of 1878–'79 surpassed that of any previous year because the demand in Europe was greater than usual, and because the facilities for transportation, both on the sea and on the land, are more perfect and extended than ever before. It is estimated that in France, during 1879–'80, the demand in grain was equivalent in value to 600,000,000 francs, and that of Great Britain was not much less. As Germany, Austria-Hungary, and other European countries likewise had short crops in 1879, the total demand for Europe was estimated in round numbers at 1,000,000,000 marks. The greater part of this demand was supplied by the United States, the remainder by Russia and India, the latter country having had an excellent crop in 1879. In addition to this, on account of improved means of transportation, American exports of meat were very much increased. After the introduction of refrigerators for shipping fresh-killed meat, a fleet of steamers was built, constructed for the special purpose of transporting live animals. On this account the exports of the United States in meat and live stock alone reached the enormous sum of $87,000,000. These phenomenal exports have just but fairly begun, and there is no telling how long they will continue. Of course, we must remember that those countries raising grain principally may have crop failures too, and a temporary check may be experienced. The grain areas of the United States extend over too many degrees of longitude and latitude to have uniform weather throughout; and as the weather is not uniform even in Europe, it cannot be expected to be so in America. Besides this, Russia and India enter into consideration. It will not be long before Australia will enter the ranks of those who supply grain and meat, and will compete with the European farmer. At the present rate an overproduction may be the consequence in the wheat-growing States of the West, which may result in a crisis, and many farmers would probably turn their attention to the production of other crops.

The inferences which the writer draws from existing facts are briefly as follows:

1. The circumstances under which America produces grain are so favorable as to make the cost of production 33⅓ per cent. less than an average in Europe; that the wheat areas are extending, and that in consequence of improved means of communication the rates of transportation are lower than in Europe, and are expected to be still further reduced.

2. That Russia, by the improvement of her agriculture and the intro-

duction of the steam-plow and other approved farm machinery, and better facilities for commercial intercourse, has been able, though surpassed by the rivalry of America, to increase her grain exports to the value of 400,000,000 marks annually, and that Egypt and India have also entered the list of countries which send their surplus to Europe.

3. As a result of improved means of transportation, a change in the international supply of cattle and meat has been wrought, which is assuming enormous proportions, serving to check the upward tendency in the price of meat, and thus proving a permanent good to the working classes of Europe.

4. That as a result of these changes in international trade in grain, meat, and cattle the farmers of Central and Western Europe are attacked by a competition which threatens to reach a crisis to be met by organized measures for relief.

5. That the recently enacted tariff and hampered railway transportation are injurious to consumers, especially the working classes, and even to the small farmer, because they lull his fears and prevent his resorting to more effective measures of relief.

6. An important remedial measure is the improvement of inland navigation, reducing cost of transportation and lessening effectively the burden of marine competition.

7. Another measure of relief is the construction of a network of local railroads, and securing by law the privilege of laying the tracks of tributary railways on the public roads.

8. That the present position of capital favors in a high degree such an undertaking as the establishment of a system of intercommunicating railways.

9. That canals should be built on an extensive scale, for the purpose of draining and watering meadows and fields and for obtaining water-power.

10. That the price of land is too high, and if raised further a crisis will be precipitated that will result in a great depreciation of land values.

11. A belief is expressed that the necessary meat and grain supplies of Central and Western Europe can still be produced at home; that in the small districts most affected by competition there should be a resort to crops that give a profit.

The author concludes with the consolatory view that food from transmarine sources cheapens the cost of living to the poor and averts a possible danger of famine, and expresses the confident opinion that the measures he suggests will avert all the evil results of competition to the German farmers. He says:

> We are of the firm conviction that by the vigorous application of the remedies suggested our farmers will not only be able to hold their own, but will positively improve their condition. Then an appropriate, international division of labor can be established, according to which every section of country can follow the pursuit returning the greatest profit for the exertions of its population; and the great blessing bestowed upon the consumers, particularly upon the poor working classes of Europe, by the importation of the surplus of the New World, will not be alloyed by the curse of impoverished farmers.
>
> We must remember that in former times Europe was stricken with famine, returning at regular intervals and assuming the terrible character of similar calamities not long since prevalent in China and in India, where in the course of a few months millions of human beings died of hunger. We must remember these things in order to appreciate the boundless blessings conferred upon the population of Europe by the shipment from transmarine sources—such shipments being made quickly on account of the improved means of transportation—thus bringing about equable prices, preventing too great a rise in those prices, and precluding for all times the possibility of a famine.

VIEWS OF DR. PAASCHE.

Dr. H. Paasche, in a series of articles in the year-book of National Economy and Statistics, published at Jena, presents statistics showing the decline in prices of agricultural products in the past decade throughout Europe, as a result of heavy importations, largely from America. He considers the effect of this competition upon the profits of grain-growing and meat production, and in many instances the losses of capital involved and the imminency of further serious losses. The following quotations are made from his writings:

The transatlantic imports of grain, though for some decades past quite considerable in English grain markets, have of late years assumed astounding proportions; and the products of American farm animals have likewise been crossing the ocean in alarming quantities. Meantime in Central Europe an unusually languishing condition of agriculture is observable; so that not only in Germany the agrarians and protectionists are clamoring for protective tariffs for the domestic products of agriculture and farm animals, but even in free-trade England occasional demands for protective legislation are expressed, in order that foreign competition might be controlled.

Depression of prices with us is certainly not wholly due to the direct imports from America, but in a great measure are attributable to declining English prices, since, by means of our intimate, direct commercial intercourse with England, our prices are subject to the same influences which tend to depress London prices.

Since 1874 the farming interests of Germany have been suffering from constantly declining prices for farm products and farm animals. Between 1874 and 1878 there was a succession of poor crops, while in America they were unprecedentedly good for this period of time. Furthermore, there was in the latter country a vast annual increase in acreage, particularly in wheat. Vanderbilt having succeeded in reducing the freight rates on his railroads by about 66 per cent., the transportation costs across the Atlantic Ocean having been made much lower, and plans having been devised by means of which fresh meats could be sent without spoiling across the ocean, American grain and meat began to appear in English and German markets, causing a depression of prices for the home products. This competition, however damaging to the farming interests of Germany, it is believed, cannot be regarded as an established fact, since it seems little likely that America will continue to have rich harvests and Germany poor ones. Another fact to be considered is this, that American farmers having found wheat to be a paying crop, they are devoting more than their usual attention to wheat raising, to the neglect of other crops. If this continues there will be a glut in the American wheat market, and if the wheat crop should be a failure, the farmers would raise less wheat and put in more of the other crops. Yet, even if these adverse circumstances should arise, America can still successfully compete in German markets because of the cheapness with which crops can be raised in the New World. This is due to the merely nominal price of land, richness of the soil, efficiency of farm help, and the almost universal use of improved farm machinery. So much for the causes of the languishing condition of German agriculture.

If the evils of American competition cannot be removed they can at least be lessened. The German farmer must let go his hold on the traditions of the past; he must arouse his energies and adapt himself to the demands and circumstances of the times. Agriculture is not what it was twenty years, yes, even ten years ago. German farming must be revolutionized and that promptly. The cost of production must be reduced, and this can only be done by labor, time, and money-saving machinery. An incidental element of improvement in our prices may be looked for as soon as the condition of English agriculture is bettered, for, as London is the commercial metropolis of Europe, London prices influence the prices in Germany.

A CALIFORNIA GERMAN'S VIEWS.

A pamphlet is published in Wismar, Germany, written by Mr. Heinrich Semler, a resident of California, to show the true significance and real causes of the North American competition in agricultural products. It is entitled *Die wahre Bedeutung und die wirklichen Ursachen der Nord-Amerikanischen Concurrenz in der landwirthschaftlichen Production.*

Mr. C. Wildbrandt, of Pisede, in an introduction to this publication, says it is not to be denied, in view of the consequences of the American

competition in their grain markets, that German farmers have before them a hopeless, dread-inspiring prospect. Still he is disinclined to give up in despair, and asks his countrymen to remember that Germany has had a Thaer, and a Liebig, and a host of scientific men who have aided in the development of their agriculture. He expresses the opinion that if the extension of agricultural area in a country thousands of miles away, where a sparse population must practice an extensive rather than intensive system of culture, can endanger the achievements of centuries of wise experience, aided by exalted science in the Fatherland, then agriculture is a frail structure, liable to be overthrown whenever cheap and broad acres of fertile soil in another country should be given to the plow. Mr. Wildbrandt derives some consolation from the fact that prices have in several instances been lower, as follows:

However, the apprehensions aroused in the minds of many in 1879 have begun to be somewhat calmed, since the prices of grain again indicate an upward tendency. In Prussia the average price of wheat per Berlin scheffel (bushel reckoned at 85 pfund—pounds) in 1879 was 8.34 marks,* exceeding the wheat price for 1851 by 2.04 marks; 1852, by 1.12 marks; 1858, by 0.71 mark; 1859, by 0.84 mark; 1862, by 0.63 mark; 1864, by 1.64 marks; 1865, by 1.50 marks; 1866, by 0.10 mark; 1869, by 0.18 mark; that is, the average price for 1879 is higher than the nine lowest annual averages of the past two decades. This fact incontrovertibly proves that on the whole the production of grain could not have exceeded the consumption sufficiently to cause alarm, particularly as 1878 was a markedly prosperous year as well in almost all European countries as in America. If in fact the increase in transatlantic exportation had been greater than the increase in European consumption, it would have found expression after so rich a harvest in an unusually low price; but the price for 1879, according to statistical reports, cannot be regarded as low. * * * Surrounded by the comforting glamour shed about us by the advantages of European culture, we are accustomed, from the height of those advantages, to view with polite contempt the "condition of things in America." * * * But we should commit a most egregious error of self-deception were we to deny that "there is another side" to all these advantages, and if we should give up to their influences our agriculture would languish and our energies be crippled in the same degree that the less ameliorated conditions of American life tend to stimulate thrift and energy.

It is generally claimed and promptly admitted by every one that the Americans are more "practical" than we are. This seems rather surprising, since quite a large percentage of the American population is of direct German origin; and it is asserted that the Germans in America, as far as capacity, amount of work performed, and business push are concerned, are quite up to the standard of the representatives of any other country. If, then, on the other side, a practical turn is developed in the Germans, it only proves that this quality is innate, and if it is more greatly developed there than here it only leads to the conclusion that the quality of practicalness is not in our environments subjected to the same stimulus as in America.

* * * He who carefully studies the contents of this book will at once recognize what is necessary for our farmers to do. It is most valuable to us in two respects: First, in that it completely dispels that ghastly apprehension about American competition, such apprehension serving only to cripple our energies and to confuse our objects; and, secondly, in that it graphically describes so many emulable qualities of the Americans, which we, in our supreme sense of safety, thus far secured by our more favorable conditions, have been ignoring but too long. Yet, if we resolve pliably to adapt ourselves to the changed conditions; to wipe out practices hurtful to us; to endeavor, free from prejudice, to improve in all we do, and to look to our own resources for the means with which to oppose the pressure of the times, German agriculture will no longer look despairingly into the future, but energized anew will wing its upward flight to prosperity. The superior advantages of social culture in Germany will, without doubt, place German agriculture far in advance of its rival, and the land of the Thaers and Liebigs will have no cause to fear a competition offered by a country which, though blessed with admirable political institutions, yet gives to husbandry a crude empirical attention.

Nor is the author, Mr. Semler, while enumerating the superior advantages of American farmers, disposed to be despondent. His desire ap-

* One mark = 23.81 cents.

pears to be to show his German friends at home how American competition can be met and its dreaded consequences averted. He says:

My desire has been (in this book) to convince the German farmers that they need not fear American competition if they will but appropriate the *self-wrought advantages* of the Americans. True, the latter have acquired their land at a low price, yet this advantage is counterbalanced by higher rates of interest and higher taxes; true, they can still practice exhaustive farming, yet the prices of their products are so low that they enjoy no material advantage in this respect. Certainly their soil cannot become more productive, and the wages for farm labor are higher and farm machinery is more costly. And while they did appear in the German market as dreaded rivals, they did so by virtue of certain self-wrought advantages, which I will again briefly enumerate:

1. The division of the land into sections, ranges, townships, thus securing squares and the locating of farm-houses to advantage.
2. The energetic application of improved machinery in all farm work.
3. Superior implements for house and field work.
4. The practical internal arrangements of the dwelling-houses, stables, and barns.
5. The skill, reliability, and endurance of the farm hands.
6. Being satisfied with three meals a day.
7. Constant contriving how to save time and labor and the speedy application of the results.
8. Division of labor and pursuit of special branches of production.
9. Willingness to undertake and to do, and a steady child-like hope in the "good time coming."
10. Political freedom and its offspring, self-government, which brings up men who are accustomed to self-help.
11. The conservative mortgage and homestead laws.
12. The great respect and sympathy ever cheerfully shown by all classes toward those persons engaged in agriculture, thus infusing continually new life into them.
13. The farmers' clubs with their practical objects.
14. The excellent organizations of commerce and collateral institutions.
15. Elevators, refrigerators, grain exchanges, common store-houses, shipping-houses, &c.
16. The harmonious co-operation of farmers and merchants, and the powerful aid given by the latter to agriculture.
17. The low rates charged by the railroads for freight, and the building of new railroads for the opening up of the agricultural districts to settlement.
18. The great attention which the press gives to agriculture and the constant endeavor of the press to urge on the farmer in the path of progress.
19. The absence of the pride of caste; the intimate intercourse of all persons with each other, no matter of what calling, by which the standard of popular intelligence is elevated, a large fund of knowledge thus reaching the poorer class of farmers.
20. The absence of social or other barriers among the farmers themselves, the latter as a class receiving the benefits of the advantages just enumerated.

If we consider how greatly the annual increase of population alone increases breadstuff demand, we cannot escape the conclusion that the greater acreage in America should not cause us fear about the disturbed relations of supply and demand. We may safely set down the population of Europe at 320,000,000; that of the United States at 50,000,000; that is, 370,000,000 together. The annual increase of population estimated at 1 per cent., and this is hardly high enough, would give us 37,000,000 souls. Estimating the consumption of grain by this increase of population in the way of bread and beverage (beer and whisky) to be 440 (pfund) pounds per head per year—and this accords with the estimates of the best authorities—the annual increase in the breadstuff demand would in this small portion of the earth amount to more than 16,000,000 zentner (a zentner is 50 kilograms), an amount altogether disproportionate to the annual increase of American exports during the last decade. Besides, in this we have ignored the fact that prosperity is an important factor in raising the demand; so that the latter is really increasing faster than we have estimated. Striking proof is shown in the movement of wheat consumption in Great Britain during the period of thirteen years from 1866 to 1879. During that period the increase of breadstuffs amounted to 26 per cent., while the increase in population can hardly be estimated so high as 13 per cent.

TRANSMARINE COMPETITION IN FOOD PRODUCTS.

A Leipsic publication on foreign competition with Germany and other European nations is entitled *Die überseeische Lebensmittel-Konkurrenz*, and written by Mr. Karl Kautsky. He reviews the facilities for pro-

duction of competing nations and cites statistics to show that the United States, La Plata, and Australia have more cattle, sheep, and swine than all Europe, which contains about four times as many people as these young nationalities. He finds that the European farmer is in danger of being forced out of the grain and cattle market, and that the business of the miller is despoiled by shipments of flour instead of wheat; that the distiller is injured by foreign manufacture of spirits from cheap corn; and he even fears that the beet-sugar industry will be injured by American competition. In view of this invasion of agriculture and allied industries he says:

More radical measures must be adopted if European agriculture shall prevail, or shall we join the free-traders, who advise us to fold our hands, since American competition, after all, is a benefit? Because, as they say, it prevents in years of crop failures a rise in prices, makes bread cheap, reduces the cost of industrial production, and altogether proves a blessing. Thus spoke the Roman tribunes, from Gracchus to Cæsar, who, in order to gain popular favor, procured cheap bread for the people. The ruin of Italy was the consequence. When the free-traders prate so much about the low cost of grain production, they forget altogether that the cheapest of products cannot be disposed of when there is no consumer. Next to the day laborer the farmer is the principal consumer in the home market. In former times crop failures did not materially affect the farmer's ability to consume, because the worse the crops the higher the prices of provisions rose. Now, the prices do not rise when the quantity of yield falls; the farmer loses the means to consume; indeed a crop failure, when he no longer has any credit, makes a proletaire of him. He swells the numbers of industrial over-population, or he emigrates, and the power of the people disappears with him. Hitherto the industrial proletariat has been saved from rapid degeneration by being steadily recruited from the country. When there are no more farmers, Europe will go down from depopulation and debility, the fields will have been turned into cattle ranges, and these into wild growth of underbrush, and this blessing-bearing future we are to permit quietly to come, because the low grain prices are profitable to a few manufacturers.

M. Kautsky gives statistics showing the progress of production in competing countries, and notes briefly their relative advantages in production. A few paragraphs will give the general tenor of his views in this connection:

Pliny says that the decline of Italian agriculture is attributable to the "Latifundium"* (a large estate, extensive possession). This opinion is only partly correct. The large estates were not so much the cause as a symptom of the ruin of agriculture. The real cause was transmarine competition—that is, Sicilian, Sardinian, and Egyptian grain; the inexhaustible fruitfulness of Egypt and of Sicily, the farms arranged on the Carthagenian plan, and the circumstance that sea transportation, particularly from Sicily and Sardinia to Latium, was less expensive than the unwieldy transportation by land from Campania, Etruria, and even from Upper Italy, caused a flooding of Italy with a mass of transmarine grain, which so much depressed the prices that the Italian small farmer could not make farming pay. In Polybius's time a night's lodging and a day's meal cost in the richest grain districts of the Peninsula (in the Romagna and Lombardy of to-day) half an ass (3 pfennige), about three-fifths of a cent, and the Prussian bushel (scheffel) of wheat brought half a denarius (35 pfennige), about 7 cents, while the normal price was 4 marks ($1). This shows that Italian grain had no sale. No wonder that the small farmers disappeared like snow before the sun.

In British India, until within a short time, no attention was paid to the production of grain, but was almost exclusively directed to the cultivation of rice. Since 1870, however, the Government has made endeavors to encourage the cultivation of wheat. In 1873 the export duties were abolished, and this act resulted, as Dr. Forbes Watson shows in his report for 1879 to the Government, in the production of from 87,000,000 to 100,000,000 hectoliters of wheat in the provinces under immediate British rule, about the same quantity as is produced in the United States†; and, besides this, 14,500,000

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* *Verum confitentibus, latifundia perdidere Italiam jam vero et provincias.*

† This is a serious understatement of the production of the United States.—STATISTICIAN.

hectoliters in the states of Punjaub, under British protection. This account of production would be increased if the Indus Valley Railroad were completed.

Canada, for the present, need hardly be considered; her exports will only be of any account when the Canada Pacific Railroad opens up the rich lands of inner Canada, which have hitherto been accessible with difficulty.

The Australian export of cereals is small in comparison with that of the United States and of East Indies.

Meantime Africa is becoming an important exporter of grain to the world's market. The fruitfulness of Egypt, this corn-crib of the ancient world, is inexhaustible on account of the annual inundation of the Nile. But just this dependence upon the inundation makes the production of grain a very uncertain one, and consequently the amount of export is fluctuating. In 1870 the export amounted to only 14,994, in 1866 12,530, and in 1865 only 1,200 ardebs. In 1879 the value of the exported grain was over 44,000,000 marks.

In Algiers the area of grain sown and the exports of grain are steadily and rapidly increasing. The grain area in 1869 was 1,684,000 hectares, the yield 10,676,000 meter-zentner (100 kilograms); in 1876, 2,949,000 hectares produced 18,019,715 meter-zentner.

We see that the quantity of grain flooding the European markets is increasing from year to year. When the projected Indian and American railroads are completed, and those of Algeria and Central Africa open up nature's treasures, then the amount of breadstuff at the disposition of Europe will be simply enormous. Even now, while there is but one competitor to be feared, the transmarine import is almost crushing. The grain-importing states of Europe require on an average 48,000,000 hectoliters of foreign grain, while in 1881 there were 114,700,000 hectoliters to cover this demand, 68,000 hectoliters coming from the United States alone. It is quite natural that this enormous excess should sufficiently depress the prices, even in this year, to bring the farmer one weighty stride nearer his ruin.

How can so terrible a competition be withstood? By means of grain duties? The grain-exporting states cannot expect much of them. What good would the duties do them, since it is not so much the object of these states to keep at a distance foreign grain as to get rid of their own surplus.

The Austrian, and above all the Hungarian, farmer is ruined as soon as the Austro-Hungarian grain export ceases; it would not even be necessary for the transmarine grain to compete in Austria-Hungary.

Besides, France and England are not thinking of making grain duties so high as to protect domestic producers, since that would ruin their industries. There remains, then, of the larger states only Germany in which salvation might be expected. But even in Germany they can no longer serve the farmer. Protective tariffs may have the effect of permitting the quiet development, free from extraneous disturbance, of a crude industry, but they cannot operate against overproduction. Protective tariffs have never yet had the power to check the downward movement of prices. For instance, the prices of the following articles, upon which there was in Austria a high protective tariff, fell quite as much as in other countries where they were not protected:

From 1874 to 1878 iron ore fell from 6 to 2.10 florins, pig iron from 11 to 5.60 florins, ordinary cotton yarn from about 200 to 126 florins, cotton goods from 200 to 128 florins, linen goods from 140 to 105 florins, glass from 40 to 24 florins, &c.

Truly, it would be a very high protective tariff that, in the face of the great overproduction of grain, as shown above, would keep transmarine grain from the German market, particularly as the cost of production in Germany as compared with that in America is very great. According to an estimate before us, it cost 8.92 marks to raise a zentner of rye in 1876, near Leipzig, in one of the best regions of Germany; and this, too, in a good year when there was a yield of 15.4 Berlin scheffel (bushel) per Prussian morgen (acre); on an average the yield is 12 scheffel per morgen, the cost of production 10.88 marks per zentner. In bad years the price of rye rises, but the cost of production is proportionately high. In Eastern Germany it costs less to raise rye, about 7.5 marks per zentner; but the average price during the latter years was only 5.5 marks. The protective tariff should therefore be high enough to raise the price of rye by from 30 to 40 per cent., that the farmer might make expenses.

But could the industries bear such a weight? If capital is strong enough, or rather if the laborer is too weak, so that the wages are not raised accordingly, then the laborer will retrench still further in consumption, if this is still possible, or he will starve, if in his desperation he shall not attempt by unlawful means to get his bread, or if the money wages should become higher the actual wages would, however, remain the same.

By such means as grain tariffs so mighty and revolutionary a movement as is called forth by transmarine competition cannot be banished. There are those, and their number is increasing, that think nothing further can be done but to leave the supplying of Europe with cereals to America; that the European farmer must do as the

Italian farmer did before him, *i. e.*, pass from agriculture over to stock-raising. It is only the legal representatives of the large estates that talk after this fashion, for the transition to feed-growing will be the death blow to the small farmer, particularly in places where there are no parish meadows.

The proprietors of large estates in all countries of Western Europe are about to follow the advice given. It was first followed in England, where the imports of grain since the repeal of the corn laws have offered uncomfortable competition. During the nine years from 1870 to 1879 the agricultural area of Great Britain became less by 400,000 acres, while the areas of meadows and pastures increased 6,800,000 acres.

M. Kautsky, in seeking a remedy, considers at some length the advantages of competing countries in "immeasurable tracts of virgin and exceedingly fertile soil" and the disadvantages under which European countries labor. One of these is the assumption of a constantly deteriorating climate, fluctuating from extremes of moisture and drought, due to the destruction of forests, the diminution of areas of natural-water reservoirs, swamps, lakes, &c. He quotes the Austrian Social Science Monthly as to Hungary:

The climate of Hungary is not constant like that of England. Hungary suffers from the extremes of dry and wet years, and therefore is obliged to deplore many a crop failure. In the seventy-five years preceding 1864 there were twenty-two crop failures, nineteen from drought and three from excessive wet and cold. The shortage in the crop of 1863 was estimated to be 126,000,000 gulden. Crop failures are becoming more and more frequent.

He canvasses the comparative cost of producing wheat in America and Europe, and concludes that in this country the cost is 5.65 francs per hectoliter, and in France 18.42 francs. He makes the cost per day for feed in fattening an ox 1.03 francs in France, and in Texas only seven-hundredths of a franc; for sheep, twelve-hundredths of a franc in France, and two-hundredths in Texas. With this advantage the Texan farmer must grow wealthy while the French farmer is consuming his capital. Another advantage in America is political. While in Europe three million able-bodied men are taken from the plow and workshops into the military service, "the land forces of the United States amount to only 27,500 men. While in Germany one per cent. of the population do military duty, only one-hundredth of one per cent. serve as soldiers in the United States." In the grain region the American farmer pays at the most 1 mark taxes per hectare, in many States (as in Texas) only 28 pfennigs per hectare; the Austrian farmer, on the other hand, at least 5 marks, and the French farmer 20 marks. Among other advantages he mentions the homestead laws and improved transportation facilities by land and sea. He notes the fact that iron supplemented wood in ship construction, and now steel is taking the place of iron; that vessels are built longer and longer; that instead of 1,500 to 1,800 tons, they now measure 5,000 tons, without increasing the number of men required for handling the freight. He considers the question of a remedy in the following words:

There are two ways in which transmarine grain competition can be combated: either it must be made more expensive or the expenses of grain production in Europe must be reduced. There is no third way while free competition lasts. Making transmarine provisions more expensive is quite simple—we need but lay a duty on them. But, as we have shown, such artificial appreciation will operate in favor of the Government only. We must therefore endeavor to enable the European farmer to produce as cheaply as the American does. Reduction in the cost of production—that is the solution of the agrarian question. But it cannot be solved by reducing the wages of labor; some would think that would be like the logic of the man who opened his main artery in order to feed himself with the blood.

Above we mentioned the cheapness of transportation. Why cannot we effect what

the grangers have done only in another way? Why not nationalize the railroads? It is absolutely necessary to reduce our standing army; then the national debt could be paid off. Yet, more heavily than the interest of the national debt, the high farm rents oppress the European farmer.

The state must enable the farmer to pass from his present system of petty farming to improved farming on a larger scale. This can be best accomplished by reviving suitably to present circumstances the old system of parish property. The state would have to furnish the land stocked and equipped on the most improved plan. The management to be left to a man elected by the parishioners, who is a scientifically educated agronomist authorized by the Government. Every parishioner would be obliged to work for a certain number of days in the year on the parish farm. The proceeds of the property would go toward paying state and parish taxes, thus saving the farmer a cash outlay. The farmer would certainly much prefer to pay his taxes in work to paying in cash. If there is a surplus over all expenses in the property, that surplus is divided equally among the parishioners. By this arrangement the poorest would be benefited most and the rich would suffer no loss.

In order that our climate may be improved, the woods must become national property. Of course we do not mean that the Government shall have any other control over the woods, as well as over railroads, than to operate for the public weal.

Now, as to improving the productiveness of the soil without great expense; and this is the most difficult problem. How can the cheapest manure be obtained? The larger towns and cities annually furnish great quantities of manure; but this redounds to the benefit of their immediate neighborhoods, since transportation increases too much the cost of manure. Measures must therefore be devised by which the products of the soil can be consumed nearer the destination of the manure—in other words, the industries must be transferred to the flat country. That this, in conjunction with the other measures proposed, would check American competition is evident. This manure, now washed into the rivers, and serving no purpose except to make the water impure, would raise the yield to such an extent that American exhaustive farming could be sharply competed with, particularly since this measure would result in permanent benefit, enriching the soil without loss, since the soluble mineral matters are given back. In the mean time American agriculture will, after one or two generations, be ruined by the exhaustion of the soil.

Only, then, when all that we have demanded—the removal of the industries to the flat country, the nationalization of railroads and forests, the general establishment of parish properties, the reduction of the army budget and of the interest on hypothecated lands—only then will the surplus of America no longer affect the ruin of European agriculture, but, in case of short crops, cover the deficit and convert a curse into a blessing. But if lazy routine and narrow-minded private interest should prevent these far-reaching, radical measures; if those in power should be content with destroying, by means of grain duties, the industries which consume the products of agriculture, or if they should, in order to get cheap bread for the industrial workmen and to get low wages for the industries, expose to *laisser faire* the best markets of the industries, *i. e.*, agriculture, then European agriculture will be destroyed, Europe will become a stony waste like Sicily and Asia Minor, or be covered over with underbrush.

GATELLIER ON CHEAP FERTILIZATION.

A treatise of E. Gatellier considers the effect of competition on French agriculture, particularly the means of successfully meeting it, and especially by cheapening the cost of fertilizers essential to profitable yields. He says of the relative expense of production:

Seeing the disastrous situation in which our wheat interests are placed by the American wheat competition, I have been led to inquire into the reasons why Americans raise wheat cheaper than we do. I have discovered that the principal of these reasons is that while with us there is an indispensable outlay for fertilizers they can be dispensed with in the virgin soil of the New World. Therefore, if we could diminish the expense of fertilizers without impairing our crops, and at the same time aim to obtain the maximum of production, the consequence would naturally be a very sensible improvement in our situation. For that purpose I have proposed to the agricultural society of Meaux to investigate the prices for farm-yard manure.

With regard to expenses in proportion to the harvest, such as harvesting, thrashing, housing, and taking to market, there is not a great difference between ours and

those of America, taking into consideration the quantities harvested on each side. However, it may be possible to reduce to some degree our expense of harvesting by making use of improved reapers.

As to the general expenses, rent, plowing, sowing, we find that the costs of cultivation are less in America because plowing is not so deep, and horses, as well as their feed, are cheaper; and sowing is less expensive in America because wheat is not nearly so dear as in France.

There is a great difference between America and our country with regard to rents and taxes. But rents depend upon the supply and the demand. It is well understood that if our farmers cannot compete with American farmers the rents will fall; but it is not in this way that we look for a fall, as that would be injurious to our national wealth. As to taxes, if there is a great difference it is because America draws from duties, and not from the land, the resources necessary to defray public expenses, whilst with us the government, and especially the departments and the counties, draw a part of their resources from taxes levied on the soil, about 15 francs per hectare. It is for the officers of the government, and not for the farmers, to cause a reduction in this respect.

EXPORTS OF AGRICULTURE.

The exports of agricultural products have been about four-fifths of the total exports of the United States. In the early history of the foreign trade the proportion was largest, above four-fifths, but the quantity was very small. In 1820 it had attained a volume of only $41,657,673. The largest figure hitherto reached was in 1881, $730,394,943. In 1870 it had only half that volume. Immigartion and farm machinery account largely for this marvelous increase.

The proportion is gradually declining, while the actual quantity is increasing. During the last ten years the percentage of agricultural exports averages only 78 per cent. This is because the exports of manufactured products have increased. In 1820 the quantity was insignificant, only $10,025,967, or 9.4 per cent. In 1882 it was $181,019,913, or 14.69 per cent. of all exports, and eighteen times as much in value.

This is a change in the direction of enduring prosperity. A nation that exports permanently the raw products of agriculture will not attain the highest prosperity. It is not desirable to bend all the agricultural energy of a vast district to the production of wheat, the market for which shall be contingent upon, first, five thousand miles of transportation, and second, the meteorology and the labor of foreign countries. We shall be permitted to export a wheat surplus on condition of underbidding the world, including the ryots of India, in price, mainly to enable foreign manufacturers to undersell our own in the textile markets of the world, and thus reduce the home demand for our cereals, which is nine times as large as the foreign. We should manufacture our cotton at home, eat our wheat and corn at home, and sell any surplus in the form of meat, butter, and cheese, thus giving employment to surplus labor, making a market for raw products, and reducing the cost of transportation to distant markets.

Wheat production, as developed in the Northwest and on the Pacific coast, is inconsistent with the practice of scientific agriculture, incompatible with rotation or any practice of progressive husbandry, and will only be a temporary resource of pioneer necessity. It is destructive of all ideas of improvement or progress, social and moral. It is not necessary to say that it destroys fertility, though it tends in that direction. It does rapidly reduce the yield, and renders crops uncertain, or failures in unpropitious seasons, by neglect of cultivation (or superficial scratching called by that name), and the consequent growth of weeds, which take possession of the fields and choke the grain, so that the wheat and tares are unable to grow together till the harvest, be-

cause the wheat is obliged to succumb before the harvest. The old story told by superficial agricultural writers, and gladly re-echoed by foreign farmers, that the soil has been exhausted by wheat, is not true. The Genesee valley can produce nearly if not quite as large wheat crops as ever, and Iowa or Nebraska soil cannot be "exhausted" by a few successive wheat crops. It is the man of the farm, his defective plan, which is want of system, and not the soil, that is at fault; and abnormal export of wheat is the *ignis fatuus* that lures him on.

The value of agricultural exports of the past year (1883) is greater than those of any previous years except 1880 and 1881. The value of manufactures exported was absolutely greater than that of any previous year. It is a hopeful indication, as the prosperity of the American farmer depends upon that of American producers in other industries, and not upon the prosperity of foreign manufacturers. The following statement of progress in exportation is from the records of the *Bureau of Statistics* of the Treasury Department:

Years.	Value of exports of domestic merchandise.	Value of exports of products of domestic agriculture.	Value of exports of merchandise other than products of domestic agriculture.	Per cent. of products of agriculture.
1820*	$51, 683, 640	$41, 657, 673	$10, 025, 967	80. 60
1830*	58, 524, 878	48, 095, 184	10, 429, 694	82. 18
1840*	111, 660, 561	92, 548, 067	19, 112, 494	82. 93
1850	134, 900, 233	108, 605, 713	26, 294, 520	80. 51
1860	316, 242, 423	256, 560, 972	59, 681, 451	81. 14
1870	455, 208, 341	361, 188, 483	94, 019, 858	79. 34
1871	478, 115, 292	368, 466, 011	109, 649, 281	77. 07
1872	476, 421, 478	368, 796, 625	107, 624, 853	77. 41
1873	575, 227, 017	446, 900, 004	128, 327, 013	77. 69
1874	633, 339, 368	501, 371, 501	131, 967, 867	79. 16
1875	559, 237, 638	430, 306, 570	128, 931, 068	76. 95
1876	594, 917, 715	456, 113, 515	138, 804, 200	76. 67
1877	632, 980, 854	459, 734, 148	173, 246, 706	72. 63
1878	695, 749, 930	536, 192, 873	159, 557, 057	77. 07
1879	699, 538, 742	546, 476, 703	153, 062, 039	78. 12
1880	823, 946, 353	685, 961, 091	137, 985, 262	83. 25
1881	883, 925, 947	730, 394, 943	153, 531, 004	82. 63
1882	733, 239, 732	552, 219, 819	181, 019, 913	75. 31
1883	804, 223, 632	619, 269, 449	184, 954, 183	77. 00

* Year ended September 30.

The proportions of exports by classes of industry for the past two years are as follows:

Products of—	1882.		1883.	
	Value.	Per cent. of total.	Value.	Per cent. of total.
Agriculture	$552, 219, 819	75. 31	$619, 269, 449	77. 00
Manufactures	103, 132, 481	14. 07	111, 890, 001	13. 91
Mining (including mineral oils)	56, 278, 887	7. 67	51, 444, 857	6. 40
Forestry	9, 138, 934	1. 25	9, 976, 143	1. 24
The fisheries	6, 197, 752	. 85	6, 276, 375	. 78
All other commodities	6, 271, 859	. 85	5, 366, 807	. 67
Total	733, 239, 732	100. 00	804, 223, 632	100. 00

Value of products of domestic agriculture exported from the United States to foreign countries during the years ending June 30, 1882 and 1883.

Articles.	Fiscal year 1882.	Fiscal year 1883.
Animals, living:	*Dollars.*	*Dollars.*
Hogs	509, 651	272, 516
Horned cattle	7, 800, 227	8, 341, 431
Horses	470, 183	475, 806
Mules	320, 130	486, 560
Sheep	603, 778	1, 154, 856
All others, and fowls	25, 147	58, 099
Bones and bone-dust	41, 266	59, 103
Bread and breadstuffs:		
Barley	151, 575	299, 137
Bread and biscuits	781, 292	829, 281
Indian corn	28, 845, 830	27, 756, 082
Indian corn-meal	994, 201	980, 798
Oats	298, 349	233, 843
Rye	946, 086	1, 657, 998
Rye-flour	28, 593	25, 070
Wheat	112, 929, 718	119, 879, 341
Wheat-flour	36, 375, 055	54, 824, 459
Other small grain and pulse	664, 687	567, 012
Maizena, farina, and all other preparations of breadstuffs used as food	655, 142	987, 829
Cotton, unmanufactured	199, 812, 644	247, 328, 721
Fruits:		
Apples, dried	228, 945	786, 800
Apples, green or ripe	539, 543	1, 085, 230
Other fruit, green, ripe, or dried	322, 229	447, 395
Preserved, in cans or otherwise	659, 681	686, 517
Glue	46, 274	62, 210
Hair, unmanufactured	267, 643	438, 897
Hay	190, 170	261, 614
Hemp, unmanufactured	21	76
Hides and skins other than fur	1, 449, 737	1, 220, 158
Hops	1, 456, 786	5, 616, 370
Oil-cake	6, 302, 828	6, 061, 699
Oils, animal:		
Lard	434, 124	353, 184
Neat's-foot and other animal	53, 736	64, 405
Oils, vegetable:		
Cotton-seed	330, 260	216, 779
Linseed	35, 970	34, 468
Provisions:		
Bacon and hams	46, 675, 774	38, 155, 952
Beef, fresh	6, 768, 881	8, 342, 131
Beef, salted or cured	3, 902, 556	3, 742, 282
Butter	2, 864, 570	2, 290, 665
Cheese	14, 058, 975	11, 134, 526
Condensed milk	200, 490	180, 505
Eggs	28, 262	75, 080
Lard	28, 975, 902	26, 618, 048
Meats, preserved	4, 208, 608	4, 578, 902
Mutton, fresh	131, 641	188, 172
Pork	7, 201, 270	6, 192, 268
Onions	61, 299	44, 074
Potatoes	441, 816	428, 478
Other vegetables, raw, prepared, or preserved	309, 891	222, 124
Rice	10, 109	8, 679
Seed:		
Cotton	114, 683	108, 491
Clover, timothy, garden, and all other	4, 104, 917	4, 311, 919
Sugar, brown	4, 251	148, 957
Tallow	4, 015, 798	3, 248, 749
Tobacco, leaf	19, 067, 721	19, 438, 066
Wax (bees')	32, 325	17, 604
Wine	67, 909	77, 280
Wool, unmanufactured	37, 327	22, 114
Unmanufactured articles:		
Bladders	6, 906	5, 115
Bristles	12, 180	10, 053
Broom-corn	170, 137	173, 468
Bulbs	10, 834	332
Casings	271, 503	359, 446
Cotton, in seed	4, 384	1, 256
Cotton, short	....	375
Feathers, crude	16, 476	6, 312
Flax, tow of	120	....
Grasses and flowers	2, 655	286
Honey, unstrained	19, 082	27, 826
Hoofs	16, 505	36, 594
Horns and horn-tips	35, 622	54, 374
Mohair	399	....

Value of products of domestic agriculture exported from the United States, &c.—Continued.

Articles.	Fiscal year 1882.	Fiscal year 1883.
Unmanufactured articles—Continued.	*Dollars.*	*Dollars.*
Nuts of all kinds	134	591
Plants and trees	32, 705	21, 172
Rennets	1, 143	1, 301
Rice-root	12, 622	6, 900
Silk, raw	....	7, 136
Teasels	5, 606	2, 404
Vine-cuttings (grape)	36, 759	16, 804
Manufactured articles:		
Blood, prepared	8, 936	2, 600
Butter, imitation	312, 854	271, 699
Cider	9, 810	36, 466
Cotton-seed meal	2, 921	247, 464
Cotton-seed foots	....	801
Glucose (grape sugar)	181, 411	196, 114
Glue, liquid	604	....
Grease not elsewhere specified	248, 768	206, 432
Grease, pulp	....	4, 500
Honey, strained	30, 592	4, 907
Horn strips and horn waste	5, 555	....
Linseed meal	....	420
Malt	12, 295	21, 208
Mill-feed	30, 665	39, 990
Oil-cake meal	58, 730	7, 547
Oils: oleomargarine (the oil)	2, 703, 038	4, 273, 220
Olive butter	....	12, 074
Poultry, dressed	173	....
Silk waste and noils	21, 571	9, 265
Sirup	2, 763	1, 204
Soap stock	44, 243	26, 250
Sugar beet	896	....
Tallow scraps	31, 746	46, 730
Total value of exports of agricultural products	552, 219, 819	619, 269, 449

THE DAIRY.

The milk yield of cows of the different breeds, and of the same breed, is so various that few realize how low the average is. The effect of improvement by breeding, selection of individuals, and feeding, makes the range of yields, between neglected runts and the select few, very great. In the best dairy districts this range is wide enough, yet a true average yield per cow for dairy States is more than twice as much as the average of certain States in which dairying is almost unknown.

Then the uses of milk, the products made, are many, and in varying proportion in different districts and States. In half of the country cheese is a product scarcely known. In a few States butter-making is an important industry; in others merely an incident of farm practice; in others still, made only by a few farmers in an unskillful way. Near large cities the supply of fresh milk and cream for daily consumption in families almost monopolizes the milk production of farms. In the South the farmers' consumption of milk as food is the largest proportion of the whole. These facts show how diverse the rate of yield and the uses in consumption are.

Thus the irrepressible statistician of the dairy convention has a field rich in possibilities for exaggeration of the products, the value, and the importance generally of the dairy interest. The aggregates are sufficiently large to satisfy a reasonable ambition for "big figures," and it is proposed here to obtain a cool and deliberate judgment of the real status of this industry.

First, the number of cows is the foundation fact for consideration. The several census enumerations make the following figures:

1850	6,385,094
1860	8,585,735
1870	8,935,332
1880	12,443,120

The period between 1860 and 1870 was not favorable to increase of cattle, and other causes prevented a full enumeration in 1870; yet these figures approximate the real numbers of the years named. The cows of villages and towns, those "not on farms"—are not included. Including these with the increase since 1880, a round estimate of fourteen millions of cows which are kept primarily for their milk would be a reasonable approximation to the actual number.

Next, it is desirable to find out how much milk is obtained for human sustenance. In this inquiry the census brings to its aid a record of butter and cheese made, and nothing more, as far as 1850 and 1860 are concerned. The cheese factory was unknown until late in the second decade, and the milk sold for family use was not reported. It was a comparatively small item. The farm consumption for family use was larger. In 1870 the factory statistics were included in the manufactures. In aggregating production the butter and cheese can easily be made equivalent to milk and added to the milk sold. Still, there is one element in the total milk production unreported—the amount consumed on the farm. In explaining results, therefore, the milk taken as food in the farmer's family must be considered, as an addition to the average given, and a small further allowance be made to the results for 1850 and 1860, on account of the milk sent for city consumption.

Number of cows on farms and products of farm dairies, returned by census of 1880.

States.	1880.			
	Milch cows.	Milk.	Butter.	Cheese.
	Number.	*Gallons.*	*Pounds.*	*Pounds.*
Maine	150,845	3,720,783	14,103,966	1,167,730
New Hampshire	90,564	5,739,128	7,247,272	807,076
Vermont	217,033	6,526,550	25,240,826	1,545,789
Massachusetts	150,435	29,662,953	9,655,587	829,528
Rhode Island	21,460	3,831,706	1,007,103	67,171
Connecticut	116,319	12,289,893	8,198,995	826,195
New England Group	746,656	61,771,013	65,453,749	5,243,489
New York	1,437,855	231,965,533	111,922,423	8,362,590
New Jersey	152,078	15,472,783	9,513,835	66,518
Pennsylvania	854,156	36,540,540	79,336,012	1,008,686
North Middle Group	2,444,089	283,978,856	200,772,270	9,437,794
Delaware	27,284	1,132,434	1,876,275	1,712
Maryland	122,907	4,722,944	7,485,871	17,416
Virginia	243,061	1,224,469	11,470,923	85,535
South Middle Group	393,252	7,079,847	20,833,069	104,663
North Carolina	232,133	446,798	7,212,507	57,380
South Carolina	139,881	257,186	3,196,851	16,018
Georgia	315,073	374,645	7,424,485	19,151
Florida	42,174	40,967	353,156	2,406
South Atlantic Group	729,261	1,119,596	18,186,999	94,955
Alabama	271,443	267,387	7,997,719	14,091
Mississippi	268,178	427,492	7,454,657	4,239
Louisiana	146,454	256,241	916,089	7,618
Texas	606,176	1,296,806	13,899,320	58,466
Arkansas	249,407	316,858	7,790,013	26,301
Tennessee	303,900	1,006,795	17,886,369	98,740
Gulf and South Group	1,845,558	3,571,579	55,944,167	209,455

Number of cows on farms and products of farm dairies, &c.—Continued.

States.	1880.			
	Milch cows.	Milk.	Butter.	Cheese.
	Number.	*Gallons.*	*Pounds.*	*Pounds.*
West Virginia	156, 956	750, 279	9, 309, 517	100, 300
Kentucky	301, 882	2, 513, 209	18, 221, 904	58, 468
Ohio	767, 043	46, 801, 510	67, 634, 263	2, 170, 245
Indiana	494, 944	6, 723, 840	37, 377, 797	367, 561
Illinois	865, 913	45, 419, 719	53, 657, 943	1, 035, 069
Ohio Basin Group	2, 586, 738	102, 208, 557	186, 201, 424	3, 731, 643
Michigan	384, 578	7, 898, 273	38, 821, 890	440, 540
Wisconsin	478, 374	25, 156, 977	33, 353, 045	2, 281, 411
Minnesota	275, 545	1, 504, 407	19, 161, 385	523, 138
Lake Group	1, 138, 497	34, 559, 657	91, 336, 320	3, 245, 089
Iowa	854, 187	15, 965, 612	55, 481, 958	1, 075, 988
Missouri	661, 405	3, 173, 017	28, 572, 124	283, 484
Kansas	418, 333	1, 360, 235	21, 671, 762	483, 987
Nebraska	161, 187	625, 783	9, 725, 198	230, 819
Colorado	28, 770	506, 706	860, 379	10, 867
Trans-Mississippi Group	2, 123, 882	21, 631, 353	116, 311, 421	2, 085, 145
California	210, 078	12, 353, 178	14, 084, 405	2, 566, 618
Oregon	59, 549	227, 540	2, 443, 725	153, 198
Washington	27, 622	226, 703	1, 356, 103	109, 200
Nevada	13, 319	149, 889	335, 188	17, 420
Pacific Coast Group	310, 568	12, 957, 310	18, 219, 421	2, 846, 436
Arizona	9, 156	42, 618	61, 817	18, 360
Dakota	40, 572	415, 119	2, 000, 955	39, 437
District of Columbia	1, 292	496, 789	20, 920	....
Idaho	12, 838	15, 627	310, 644	20, 295
Montana	11, 308	41, 165	403, 738	55, 570
New Mexico	12, 955	10, 036	44, 827	10, 501
Utah	32, 768	155, 263	1, 052, 903	126, 727
Wyoming	3, 730	75, 343	105, 643	2, 930
Rocky Mountain Group	124, 619	1, 251, 960	4, 001, 447	273, 820
United States	12, 443, 120	530, 129, 728	777, 260, 287	27, 272, 489

Number of butter and cheese factories, products made, and their value, ascertained by census of manufactures, 1880.

States and Territories.	All factories.		Cheese factories.	
	Number.	Milk used.	Cheese made.	Value of products.
		Pounds.	*Pounds.*	*Dollars.*
Arizona	2	184, 000	17,700	6, 195
California	216	57, 471, 634	1, 154, 121	122, 967
Colorado	2	667, 000	64, 500	8, 385
Connecticut	16	10, 621, 660	201, 820	19, 762
Dakota	4	125, 200	700	140
Delaware	3	620, 000	....	....
District of Columbia	1	1, 825, 000	....	....
Idaho	6	1, 098, 000	97, 000	12, 535
Illinois	285	316, 636, 778	4, 977, 286	462, 178
Indiana	49	20, 826, 912	1, 153, 714	111, 060
Iowa	244	181, 635, 746	2, 302, 936	215, 729
Kansas	48	7, 983, 102	791, 384	70, 247
Kentucky	8	1, 276, 900	....	....
Maine	41	7, 637, 901	777, 365	73, 942
Maryland	14	5, 821, 000	....	....
Massachusetts	22	16, 671, 069	1, 093, 943	99, 297
Michigan	74	35, 161, 812	3, 291, 738	292, 971
Minnesota	27	6, 424, 923	452, 191	41, 618
Missouri	30	9, 185, 585	550, 265	54, 219

Number of butter and cheese factories, products made, &c.—Continued.

States and Territories.	All factories.		Cheese factories.	
	Number.	Milk used.	Cheese made.	Value of products.
		Pounds.	*Pounds.*	*Dollars.*
Montana	3	470, 000	24, 500	4, 660
Nebraska	21	4, 443, 801	273, 506	26, 077
Nevada	2	87, 500	....	....
New Hampshire	2	2, 539, 868	....	....
New Jersey	11	9, 683, 992	36, 400	10, 920
New York	1, 652	1, 335, 333, 504	108, 722, 852	8, 720, 490
North Carolina	2	19, 000	....	....
Ohio	452	325, 527, 447	17, 808, 191	1, 361, 124
Oregon	24	3, 467, 942	146, 534	18, 548
Pennsylvania	146	98, 218, 237	6, 087, 805	487, 629
Tennessee	2	198, 000	9, 000	900
Utah	11	1, 645, 985	140, 022	18, 974
Vermont	85	48, 440, 401	4, 575, 341	389, 956
Virginia	4	964, 500	26, 000	2, 600
Washington	2	1, 684, 860	70, 000	7, 000
West Virginia	7	987, 929	96, 687	10, 238
Wisconsin	414	181, 841, 161	16, 806, 994	1, 340, 860
Total	3, 932	2, 747, 427, 449	171, 750, 495	13, 991, 221

States and Territories.	Butter factories.		Butter and skim cheese factories.		
	Butter made.	Value of products.	Butter made.	Cheese made.	Value of products.
	Pounds.	*Dollars.*	*Pounds.*	*Pounds.*	*Dollars.*
Arizona	400	200	....	....	....
California	2, 074, 344	467, 467	....	....	....
Colorado	2, 100	840	....	....	....
Connecticut	93, 365	28, 127	126, 546	23, 662	57, 684
Dakota	5, 800	2, 120	....	....	....
Delaware	25, 800	7, 710	....	....	....
District of Columbia	....	....	67, 600	155, 460	44, 920
Idaho	3, 600	704	....	....	....
Illinois	2, 414, 668	591, 604	4, 136, 361	15, 240, 839	2, 374, 562
Indiana	281, 232	87, 059	53, 287	155, 550	26, 930
Iowa	5, 458, 595	1, 304, 763	724, 578	473, 877	215, 908
Kansas	11, 482	2, 536	....	....	....
Kentucky	49, 100	14, 178	....	....	....
Maine	6, 000	1, 650	....	....	....
Maryland	190, 525	69, 616	38, 800	62, 000	18, 340
Massachusetts	52, 150	28, 737	92, 067	277, 922	47, 487
Michigan	9, 850	1, 994	33, 366	221, 307	22, 912
Minnesota	62, 450	14, 426	21, 000	10, 000	6, 050
Missouri	126, 884	32, 989	13, 980	39, 800	8, 920
Montana	9, 000	3, 240	....	....	....
Nebraska	20, 672	4, 456	45, 100	50, 447	15, 789
Nevada	3, 500	1. 587	....	....	....
New Hampshire	99, 068	27, 887	....	....	....
New Jersey	15, 600	3, 900	342, 802	466, 818	108, 243
New York	4, 197, 424	870, 383	4, 758, 354	12, 078, 272	1, 652, 089
North Carolina	1, 000	250	....	....	....
Ohio	235, 341	39, 933	1, 852, 902	12, 553, 247	1, 355, 736
Oregon	84, 500	24, 668	....	....	....
Pennsylvania	453, 020	110, 563	533, 820	1, 870, 246	317, 276
Tennessee	3, 600	1, 080	....	....	....
Utah	12, 020	2, 954	....	....	....
Vermont	5, 000	1, 100	6, 837	8, 500	2, 066
Virginia	29, 100	8, 021	....	....	....
Washington	47, 963	11, 820	....	....	....
West Virginia	....	....	....	....	....
Wisconsin	386, 010	99, 673	103, 281	446, 919	60, 554
Total	16, 471, 163	3, 868, 235	12, 950, 621	44, 134, 866	6, 335, 466

Number of cows on farms, and products of farm dairies, with returns of products manufactured in factories, by census of 1870.

Groups.	Cows.	Butter made.	Cheese made.	Milk sold.	PRODUCTS. Cheese.	Other products.	All products.
	Number.	*Pounds.*	*Pounds.*	*Gallons.*	*Pounds.*	*Dolls.*	*Dollars.*
Maine	139, 259	11, 636, 482	1, 152, 590	1, 374, 091	......	......	......
New Hampshire	90, 583	5, 965, 080	849, 118	2, 352, 884	23, 250	......	4, 650
Vermont	180, 285	17, 844, 396	4, 830, 700	3, 835, 840	2, 984, 179	......	445, 323
Massachusetts	114, 771	6, 559, 161	2, 245, 873	15, 284, 057	1, 885, 436	......	321, 900
Rhode Island	18, 806	941, 199	81, 976	1, 944, 044	......	......	......
Connecticut	98, 889	6, 716, 007	2, 031, 194	6, 253, 259	231, 700	......	38, 024
New England Group	642, 593	49, 662, 325	11, 191, 451	31, 044, 175	5, 124, 565	......	809, 897
New York	1, 350, 661	107, 147, 526	22, 769, 964	135, 775, 919	78, 006, 048	20, 471	12, 164, 065
New Jersey	133, 331	8, 266, 023	38, 229	5, 373, 323	440, 107	2, 875	52, 147
Pennsylvania	706, 437	60, 834, 644	1, 145, 209	14, 411, 729	1, 647, 467	33, 780	268, 702
North Middle Group	2, 190, 429	176, 248, 193	23, 953, 402	155, 560, 971	80, 093, 622	57, 126	12, 484, 914
Delaware	24, 082	1, 171, 963	315	758, 603	......	......	......
Maryland	94, 794	5, 014, 729	6, 732	1, 520, 101	......	......	......
Virginia	188, 471	6, 979, 269	71, 743	266, 812	12, 500	......	2, 310
South Middle Group	307, 347	13, 165, 961	78, 790	2, 545, 516	12, 500	......	2, 310
North Carolina	196, 731	4, 297, 834	75, 185	17, 145	48, 800	......	9, 760
South Carolina	98, 693	1, 461, 980	169	241, 815	......	......	......
Georgia	231, 310	4, 499, 572	4, 292	109, 139	......	......	......
Florida	61, 922	100, 989	25	3, 002	......	......	......
South Atlantic Group	588, 656	10, 360, 375	79, 671	371, 101	48, 800	......	9, 760
Alabama	170, 640	3, 213, 753	2, 732	104 657	......	......	......
Mississippi	173, 899	2, 613, 521	3, 099	17, 052	......	......	......
Louisiana	102, 076	322, 405	11, 747	833, 928	......	......	......
Texas	428, 048	3, 712, 747	34, 342	62, 771	......	......	......
Arkansas	128, 959	2, 753, 931	2, 119	31, 350	......	......	......
Tennessee	243, 197	9, 571, 069	142, 240	415, 786	......	......	......
Gulf and South Group	1, 246, 819	22, 187, 426	196, 279	1, 465, 544	......	......	......
West Virginia	104, 434	5, 044, 475	32, 429	144, 895	......	......	......
Kentucky	247, 615	11, 874, 978	115, 219	1, 345, 779	246, 000	......	42, 000
Ohio	654, 390	50, 266, 372	8, 169, 486	22, 275, 344	15, 984, 390	450	2, 287, 804
Indiana	393, 736	22, 915, 385	283, 807	936, 983	107, 680	......	16, 076
Illinois	640, 321	36, 083, 405	1, 661, 703	9, 258, 545	4, 072, 301	1, 000	557, 356
Ohio Basin Group	2, 040, 496	126, 184, 615	10, 262, 644	33, 961, 546	20, 410, 371	1, 450	2, 903, 236
Michigan	250, 859	24, 400, 185	670, 804	2, 277, 122	1, 650, 997	70	239, 659
Wisconsin	308, 377	22, 473, 036	1, 591, 798	2, 059, 105	1, 696, 783	500	249, 056
Minnesota	121, 467	9, 522, 010	233, 977	208, 130	37, 500	......	5, 850
Lake Group	680, 703	56, 395, 231	2, 496, 579	4, 544, 357	3, 385, 280	570	494, 565
Iowa	369, 811	27, 512, 179	1, 087, 741	688, 800	256, 906	......	44, 590
Missouri	398, 515	14, 455, 825	204, 090	857, 704	9, 785	......	1, 943
Kansas	123, 440	5, 022, 758	226, 607	196, 662	15, 000	......	2, 700
Nebraska	28, 940	1, 539, 535	46, 142	95, 059	32, 400	1, 950	7, 270
Colorado	25, 017	392, 920	33, 626	19, 520	4, 000	......	1, 280
Trans-Mississippi Group	945, 723	48, 923, 217	1, 598, 206	1, 857, 745	318, 091	1, 950	57, 783
California	164, 093	7, 969, 744	3, 395, 074	3, 693, 021	......	......	......
Oregon	48, 325	1, 418, 373	79, 333	107, 367	40, 000	......	8, 400
Washington	16, 938	407, 306	17, 465	21, 060	......	......	......
Nevada	6, 174	110, 880	......	63, 850	......	......	......
Pacific Coast Group	235, 530	9, 906, 303	3, 491, 872	3, 885, 298	40, 000	......	8, 400
Arizona	938	800	14, 500	4, 800	......	......	......
Dakota	4, 151	209, 735	1, 850	......	......	......	......
District of Columbia	657	4, 495	......	126, 077	......	......	......
Idaho	4, 171	111, 480	4, 464	11, 250	......	......	......
Montana	12, 432	408, 080	25, 603	105, 186	2, 000	......	800
New Mexico	16, 417	12, 912	27, 239	813	......	......	......
Utah	17, 563	310, 335	69, 603	11, 240	......	......	......
Wyoming	707	1, 200	......	4, 980	......	......	......
Rocky Mountain Group	57, 036	1, 059, 037	143, 259	264, 346	2, 000	......	800
United States	8, 935, 332	514, 092, 683	53, 492, 153	235, 500, 599	109, 435, 229	61, 096	16, 771, 665

Number of cows on farms, and products of farm dairies, returned by census of 1850 *and* 1860.

States.	1860.			1850.		
	Milch cows.	Butter.	Cheese.	Milch cows.	Butter.	Cheese.
	Number.	*Pounds.*	*Pounds.*	*Number.*	*Pounds.*	*Pounds.*
Maine	147, 314	11, 687, 781	1, 799, 862	133, 556	9, 243, 811	2, 434, 454
New Hampshire	94, 880	6, 956, 764	2, 232, 092	94, 277	6, 977, 056	3, 196, 563
Vermont	174, 667	15, 900, 359	8, 215, 030	146, 128	12, 137, 980	8, 720, 834
Massachusetts	144, 492	8, 297, 936	5, 294, 090	130, 099	8, 071, 370	7, 088, 142
Rhode Island	19, 700	1, 021, 767	181, 511	18, 698	995, 670	316, 508
Connecticut	98, 877	7, 620, 912	3, 898, 411	85, 461	6, 498, 119	5, 363, 277
New England Group	679, 930	51, 485, 519	21, 620, 996	608, 219	43, 924, 006	27, 119, 778
New York	1, 123, 634	103, 097, 280	48, 548, 289	931, 324	79, 766, 094	49, 741, 413
New Jersey	138, 818	10, 714, 447	182, 172	118, 736	9, 487, 210	365, 756
Pennsylvania	673, 547	58, 653, 511	2, 508, 556	530, 224	39, 878, 418	2, 505, 034
North Middle Group	1, 935, 999	172, 465, 238	51, 239, 017	1, 580, 284	129, 131, 722	52, 612, 203
Delaware	22, 595	1, 430, 502	6, 579	19, 248	1, 055, 308	3, 187
Maryland	99, 463	5, 265, 295	8, 342	86, 856	3, 806, 160	3, 975
Virginia	330, 713	13, 464, 722	280, 852	317, 619	11, 089, 359	436, 292
South Middle Group	452, 771	20, 160, 519	295, 773	423, 723	15, 950, 827	443, 454
North Carolina	228, 623	4, 735, 495	51, 119	221, 799	4, 146, 290	95, 921
South Carolina	163, 938	3, 177, 934	1, 543	193, 244	2, 981, 850	4, 970
Georgia	299, 688	5, 439, 765	15, 587	334, 223	4, 640, 559	46, 976
Florida	92, 974	408, 855	5, 280	72, 876	371, 498	18, 015
South Atlantic Group	785, 223	13, 762, 049	73, 529	822, 142	12, 140, 197	165, 882
Alabama	230, 537	6, 028, 478	15, 923	227, 791	4, 008, 811	31, 412
Mississippi	207, 646	5, 006, 610	4, 427	214, 231	4, 346, 234	21, 191
Louisiana	129, 662	1, 444, 742	6, 153	105, 576	683, 069	1, 957
Texas	601, 540	5, 850, 583	275, 128	217, 811	2, 344, 900	95, 299
Arkansas	171, 003	4, 067, 556	16, 810	93, 151	1, 854, 239	30, 088
Tennessee	249, 514	10, 017, 787	135, 575	250, 456	8, 139, 585	177, 681
Gulf Coast Group	1, 589, 902	32, 415, 756	454, 016	1, 109, 016	21, 376, 838	357, 628
Kentucky	269, 215	11, 716, 609	190, 400	247, 475	9, 947, 523	213, 954
Ohio	676, 585	48, 543, 162	21, 618, 893	544, 499	34, 449, 379	20, 819, 542
Indiana	363, 553	18, 306, 651	605, 795	284, 554	12, 881, 535	624, 564
Illinois	522, 634,	28, 052, 551	1, 848, 557	294, 671	12, 526, 543	1, 278, 225
Ohio Basin Group	1, 831, 987	106, 618, 973	24, 263, 645	1, 371, 199	69, 804, 980	22, 936, 285
Michigan	179, 543	15, 503, 482	1, 641, 897	99, 676	7, 065, 878	1, 011, 492
Wisconsin	203, 001	13, 611, 328	1, 104, 300	64, 339	3, 633, 750	400, 283
Minnesota	40, 344	2, 957, 673	199, 314	607	1, 100	....
Lake Group	422, 888	32, 072, 483	2, 945, 511	164, 622	10, 700, 728	1, 411, 775
Iowa	189, 802	11, 953, 666	918, 635	45, 704	2, 171, 188	209, 840
Missouri	345, 243	12, 704, 837	259, 633	230, 169	7, 834, 359	203, 572
Kansas	28, 550	1, 093, 497	29, 045	....	....	....
Nebraska	6, 995	342, 541	12, 342	....	....	....
Colorado	....	....	....	....	....	....
Trans-Mississippi Group	570, 590	26, 094, 541	1, 219, 655	275, 873	10, 005, 547	413, 412
California	205, 407	3, 095, 035	1, 343, 689	4, 280	705	150
Oregon	53, 170	1, 000, 157	105, 379	9, 427	211, 464	36, 980
Washington	9, 660	153, 092	12, 146	....	....	....
Nevada	947	7, 700	....	....	....	....
Pacific Coast Group	269, 184	4, 255, 984	1, 461, 214	13, 707	212, 169	37, 130
Arizona	....	....	....	....	....	....
Dakota	286	2, 170	....	....	....	....
District of Columbia	639	18, 835	....	813	14, 872	1, 500
Idaho	....	....	....	....	....	....
Montana	....	....	....	....	....	....
New Mexico	34, 369	13, 259	37, 240	10, 635	111	5, 848
Utah	11, 967	316, 046	53, 331	4, 861	83, 309	30, 998
Wyoming	....	....	....	....	....	....
Rocky Mountain Group	47, 261	350, 310	90, 571	16, 309	98, 292	38, 346
United States	8, 585, 735	459, 681, 372	103, 663, 927	6, 385, 094	313, 345, 306	105, 535, 893

Gallons of milk sold from farms, or manufactured in farm dairies, and reported in the census of farm production, in equivalent gallons of milk, for 1880 *and* 1870.

States.	1880.		1870.	
	Gallons of milk sold and manufactured.	Average yield per cow.	Gallons of milk sold and manufactured.	Average yield per cow.
Maine	47, 395, 033	314. 2	37, 628, 225	270. 2
New Hampshire	28, 422, 533	313. 8	21, 238, 762	234. 5
Vermont	84, 052, 448	387. 3	63, 094, 845	349. 5
Massachusetts	59, 597, 497	396. 2	37, 581, 725	327. 4
Rhode Island	6, 931, 381	323. 0	4, 863, 280	258. 6
Connecticut	37, 850, 772	325. 4	28, 771, 006	290. 9
New England Group	264, 249, 664	353. 9	193, 087, 843	300. 5
New York	577, 489, 157	401. 6	483, 783, 455	358. 2
New Jersey	44, 091, 892	289. 9	30, 215, 993	226. 6
Pennsylvania	275, 725, 376	322. 8	198, 251, 738	280. 6
North Middle Group	897, 306, 425	367. 1	712, 251, 186	325. 2
Delaware	6, 763, 256	247. 9	4, 274, 860	177. 5
Maryland	27, 200, 876	221. 3	16, 572, 142	174. 8
Virginia	35, 737, 029	147. 0	21, 288, 319	113. 0
South Middle Group	69, 701, 161	177. 2	42, 135, 321	137. 1
North Carolina	22, 151, 262	95. 4	12, 998, 363	66. 1
South Carolina	9, 866, 427	70. 5	4, 627, 952	46. 9
Georgia	22, 670, 443	72. 0	13, 612, 862	58. 9
Florida	1, 103, 242	26. 2	305, 998	4. 9
South Atlantic Group	55, 791, 374	76. 5	31, 545, 175	53. 6
Alabama	24, 276, 984	89. 4	9, 749, 103	57. 1
Mississippi	22, 796, 408	85. 0	7, 861, 231	45. 2
Louisiana	3, 013, 396	20. 6	1, 814, 848	17. 8
Texas	43, 062, 976	71. 0	11, 241, 078	26. 3
Arkansas	23, 717, 582	95. 1	8, 295, 615	64. 3
Tennessee	54, 781, 099	180. 3	29, 294, 940	120. 5
Gulf and South Group	171, 648, 445	93. 0	68, 256, 815	54. 7
West Virginia	28, 795, 847	183. 5	15, 316, 154	146. 7
Kentucky	57, 217, 134	189. 5	37, 105, 135	149. 9
Ohio	252, 236, 278	328. 8	182, 605, 527	279. 0
Indiana	119, 286, 052	241. 0	70, 014, 246	177. 8
Illinois	207, 601, 129	239. 7	119, 447, 414	186. 5
Ohio Basin Group	665, 136, 440	257. 1	424, 488, 476	208. 0
Michigan	124, 877, 906	324. 7	76, 260, 282	304. 0
Wisconsin	127, 877, 758	267. 3	71, 335, 310	231. 3
Minnesota	59, 598, 890	216. 3	29, 047, 133	239. 1
Lake Group	312, 354, 554	274. 4	176, 642, 725	259. 5
Iowa	183, 666, 805	215. 0	84, 494, 368	228. 5
Missouri	89, 220, 120	134. 9	44, 463, 284	111. 6
Kansas	66, 940, 172	160. 0	15, 520, 311	125. 8
Nebraska	30, 070, 666	186. 6	4, 767, 496	164. 7
Colorado	3, 100, 521	107. 8	1, 237, 510	49. 5
Trans-Mississippi Group	372, 998, 284	175. 6	150, 491, 969	159. 1
California	57, 600, 781	274. 2	31, 563, 172	192. 4
Oregon	7, 737, 446	129. 9	4, 455, 041	92. 2
Washington	4, 422, 412	160. 1	1, 263, 354	74. 6
Nevada	1, 175, 776	88. 3	396, 490	64. 2
Pacific Coast Group	70, 936, 415	228. 4	37, 678, 057	160. 0
Arizona	249, 489	27. 2	24, 117	25. 7
Dakota	6, 463, 994	159. 3	631, 363	152. 1
District of Columbia	559, 549	433. 1	139, 562	212. 4
Idaho	971, 237	75. 7	350, 898	84. 1
Montana	1, 317, 211	116. 5	1, 359, 296	109. 3
New Mexico	156, 768	12. 1	71, 328	4. 3
Utah	3, 461, 820	105. 6	1, 023, 449	58. 3
Wyoming	395, 690	106. 1	8, 580	12. 1
Rocky Mountain Group	13, 575, 758	108. 9	3, 608, 593	63. 3

Gallons of milk sold from farms, or manufactured in farm dairies, &c.—Continued.

States.	1860.		1850.	
	Gallons of milk sold and manufactured.	Average yield per cow.	Gallons of milk sold and manufactured.	Average yield per cow.
Maine	37, 163, 182	252. 3	30, 571, 629	228. 9
New Hampshire	23, 474, 399	247. 4	24, 660, 492	261. 6
Vermont	57, 285, 279	328. 0	46, 588, 246	318. 8
Massachusetts	31, 070, 246	215. 0	32, 483, 609	249. 7
Rhode Island	3, 277, 064	166. 3	3, 356, 269	179. 5
Connecticut	27, 410, 882	277. 2	25, 751, 514	301. 3
New England Group	179, 681, 052	264. 3	163, 411, 759	268. 7
New York	365, 931, 510	325. 7	297, 329, 931	319. 3
New Jersey	32, 355, 875	233. 1	28, 888, 345	243. 3
Pennsylvania	178, 887, 182	265. 6	122, 557, 794	231. 1
North Middle Group	577, 174, 567	298. 1	448, 776, 070	284. 0
Delaware	4, 299, 182	190. 3	3, 169, 642	164. 7
Maryland	15, 805, 617	158. 9	11, 423, 118	131. 5
Virginia	40, 721, 827	123. 1	33, 777, 084	106. 3
South Middle Group	60, 826, 626	134. 3	48, 369, 844	114. 2
North Carolina	14, 266, 124	62. 4	12, 550, 778	56. 6
South Carolina	9, 535, 602	58. 2	8, 951, 348	46. 3
Georgia	16, 337, 480	54. 5	13, 976, 482	41. 8
Florida	1, 232, 725	13. 3	1, 135, 512	15. 6
South Atlantic Group	41, 371, 931	52. 7	36, 614, 120	44. 5
Alabama	18, 104, 011	78. 5	12, 063, 080	53. 0
Mississippi	15, 024, 995	72. 4	13, 063, 425	61. 0
Louisiana	4, 341, 404	33. 5	2, 051, 490	19. 4
Texas	17, 872, 732	29. 7	7, 145, 882	32. 8
Arkansas	12, 222, 280	71. 5	5, 597, 820	60. 1
Tennessee	30, 211, 532	121. 1	24, 626, 049	98. 3
Gulf and South Group	97, 776, 954	61. 5	64, 547, 746	58. 2
West Virginia	....	....	....	....
Kentucky	35, 371, 960	131. 4	30, 092, 182	121. 6
Ohio	170, 851, 528	252. 5	127, 637, 603	234. 4
Indiana	55, 626, 714	153. 0	39, 373, 263	138. 4
Illinois	86, 314, 303	165. 2	39, 070, 892	132. 6
Ohio Basin Group	348, 164, 565	190. 0	236, 173, 940	172. 2
Michigan	48, 425, 992	269. 7	22, 377, 708	224. 5
Wisconsin	42, 122, 334	207. 5	11, 368, 247	176. 7
Minnesota	9, 105, 552	225. 7	3, 300	5. 4
Lake Group	99, 653, 878	235. 7	33, 749, 255	205. 0
Iowa	36, 932, 739	194. 6	6, 758, 377	147. 9
Missouri	38, 417, 416	111. 3	23, 740, 578	103. 1
Kansas	3, 314, 377	116. 1	....	....
Nebraska	1, 042, 022	149. 0	....	....
Colorado	....	....	....	....
Trans-Mississippi Group	79, 706, 554	139. 7	30, 498, 955	110. 6
California	10, 852, 742	52. 8	2, 290	0. 5
Oregon	3, 123, 413	58. 7	677, 535	71. 9
Washington	473, 446	49. 0	....	....
Nevada	23, 100	24. 4	....	....
Pacific Coast Group	14, 472, 701	54. 0	679, 825	49. 6
Arizona	....	....	....	....
Dakota	6, 510	22. 8	....	....
District of Columbia	56, 505	88. 4	46, 366	57. 0
Idaho	....	....	....	....
Montana	....	....	....	....
New Mexico	83, 224	2. 4	7, 156	0. 7
Utah	1, 010, 357	84. 4	286, 091	58. 9
Wyoming	....	....	....	....
Rocky Mountain Group	1, 156, 596	24. 5	339, 613	20. 8

Average number of pounds of butter per cow, as reported respectively in the census of 1880, 1870, 1860, *and* 1850.

Groups of States and Territories.	1880.		1870.		1860.		1850.	
	Butter.	Cheese.	Butter.	Cheese.	Butter.	Cheese.	Butter.	Cheese.
	Lbs.	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*
New England Group	87.7	7.0	77.3	17.4	75.7	31.8	72.2	44.6
North Middle Group	82.1	3.9	80.5	10.9	89.1	26.5	81.7	33.3
South Middle Group	53.0	0.3	42.8	0.3	44.5	0.7	37.6	1.0
South Atlantic Group	24.9	0.1	17.6	0.1	17.5	0.1	14.8	0.2
Gulf Coast Group	30.3	0.1	17.8	0.2	20.4	0.3	19.3	0.3
Ohio Basin Group	72.0	1.4	61.8	5.0	58.2	13.2	50.9	16.7
Lake Group	80.2	2.9	82.8	3.7	75.8	7.0	65.0	8.6
Trans-Mississippi Group	54.8	1.0	51.7	1.7	45.7	2.1	36.3	1.5
Pacific Coast Group	58.7	9.2	42.1	14.8	15.8	5.4	15.5	2.7
Rocky Mountain Group	32.1	2.2	18.6	2.5	7.4	1.9	6.0	2.4

SECTION OF FREIGHT RATES.

By a requirement of Congress this section of the Statistical Division was organized July 1, 1882. Since that time there have been published, in each monthly crop report, tabular statements showing the rates and changes of rates of freight on principal agricultural products, by rail and water, from the more important points of shipment to the principal markets. Not only have the through rates been accurately presented, but a great mass of local rates from minor points along the branch roads or feeders of the several trunk lines. Special rates on live-stock, coal, cotton, rice, &c., have been published from time to time as changes have taken place, for the information of farmers who wish to forward their products to the best markets, with an intelligent view of the cost of their transportation.

Rates of freight on wheat, corn, flour, beef, pork, lard, cotton, tobacco, &c., that were in actual operation on the first of each month have been published, showing the cost of transporting our agricultural products to foreign countries.

There was published in the monthly crop report for February and April of the present year an elaborate statement of both local and through rates of freight on grain, flour, live-stock, &c., in Europe; and this Department is indebted to Messrs. J. Grierson, E. I. Pearson, and Henry Oakley, of London, for the valuable information and data furnished to our London agent, E. J. Moffat, relative to this subject. The Department is also indebted to the general freight agents of the railroad companies, and agents of the steamboat and steamship lines for their promptness and willingness in furnishing through and local rates, routes, connections, and such general information as was desired; and also to Albert Fink, chairman joint executive committee and commissioner, Trunk Line Commission, 346 Broadway, New York, for the proceedings of their meetings; and to Virgil Powers, general commissioner of the Southern Railway and Steamship Association, for the same courtesy.

The following list shows the names of railroad and steamship companies whose rates of freight and their changes have been published during the past year:

RAILROAD LINES.

Pennsylvania Railroad Company.
Baltimore and Ohio Railroad Company.
New York, Lake Erie and Western Railroad Company.

New York Central and Hudson River Railroad Company.
Grand Trunk Railway Company.
Boston and Albany Railroad Company.
New York and New England Railroad Company.
Wilmington and Weldon Railroad Company.
Northeastern Railroad Company (S. C.).
Chesapeake and Ohio Railroad Company.
Chesapeake, Ohio and Southwestern Railroad Company.
Georgia Railroad Company.
Mobile and Ohio Railroad Company.
New York, Chicago and Saint Louis Railway Company.
Lake Shore and Michigan Southern Railway Company.
Pennsylvania Company.
Chicago, Saint Louis and Pittsburgh Railroad Company.
Chicago, Rock Island and Pacific Railway Company.
Union Pacific Railway Company.
Central Pacific Railway Company.
Chicago, Burlington and Quincy Railroad Company.
Chicago and Alton Railroad Company.
Wabash, Saint Louis and Pacific Railway Company.
Chicago and Northwestern Railway Company.
Chicago, Saint Paul, Minneapolis and Omaha Railway Company.
Chicago, Milwaukee and Saint Paul Railway Company.
Saint Paul, Minneapolis and Manitoba Railway Company.

STEAMBOAT AND STEAMSHIP LINES.

Monarch Steamship Line.
Guion Steamship Line.
Anchor Steamship Line.
Inman Steamship Line.
White Star Steamship Line.
General Trans-Atlantic Steamship Company.
North German Lloyd Steamship Company.
Ocean Steamship Company of Savannah.
New York and Charleston Steamship Company.
Merchants and Miners' Transportation Company.
Portland Steam Packet Company.
Winsor Line.
Norwich and Worcester Line.
Old Colony Steamboat Company.

RAILROAD CONSTRUCTION.

Divisions.	Miles operated December 31, 1882.	Per cent. of total of United States.	Increase.		Per cent. of increase in two years.
			1882.	1881.	
New England States	6,155	5.4	59.75	114.10	2.9
Middle States	17,922	15.8	1,468.38	564.27	12.8
Southern States	17,693	15.6	1,506.43	1,314.57	19.0
Western States	65,962	58.2	7,778.80	7,128.09	20.2
Pacific States	5,597	5.0	777.57	668.20	34.8
Total	**113,329**	**100.0**	**11,590.93**	**9,789.23**	**23.3**

This was a year ago. The increase of 1883 is large. The increase in railroad construction according to these figures, which are compiled from Poor's Manual, is almost a fourth of the aggregate of existing mileage. The work has been most active on the Pacific slope; it was also very heavy in the Western and Southern States. This is nearly equal to the mileage of all other countries in the world. Europe is credited with 107,380 miles; Asia with 10,207; Australasia, 5,427; Africa, 3,129.

The following table shows the number of miles in operation in each State:

States and Territories.	Miles operated December 31, 1882.	Per cent. of total of United States.	Increase. 1882.	Increase. 1881.	Per cent. of increase.
Maine	1,056	9	29.25	23.25	5.2
New Hampshire	1,038	9	17.50	6.81	2.4
Vermont	920	8	2.00	2.00	0.4
Massachusetts	1,967	1.7	8.30	43.94	2.7
Rhode Island	212	2	....	1.25	6
Connecticut	962	8	2.70	36.85	4.3
New York	7,037	6.2	705.05	269.61	16.1
New Jersey	1,870	1.7	89.41	89.29	10.6
Pennsylvania	6,857	6.1	526.29	165.37	11.2
Delaware	282	2	6.78	....	2.5
Maryland and District of Columbia	1,063	9	33.46	25.00	5.8
West Virginia	813	7	107.39	15.00	17.7
Virginia	2,446	2.2	221.85	327.19	28.9
North Carolina	1,759	1.6	136.75	158.75	20.2
South Carolina	1,517	1.3	38.25	52.00	6.3
Georgia	2,874	2.5	334.40	101.50	17.9
Florida	973	9	271.43	145.00	74.8
Alabama	1,909	1.7	50.00	14.00	3.5
Mississippi	1,309	1.2	120.50	55.50	15.5
Louisiana	1,032	9	94.81	262.00	52.9
Tennessee	2,067	1.8	165.44	56.33	12.0
Kentucky	1,807	1.6	73.00	142.30	13.5
Ohio	6,931	6.1	610.33	496.56	19.0
Michigan	4,654	4.1	327.72	345.48	16.9
Indiana	5,018	4.4	611.65	386.05	24.8
Illinois	8,752	7.7	442.89	409.20	10.8
Wisconsin	3,824	3.4	352.86	302.05	20.7
Minnesota	3,974	3.5	396.74	186.76	17.2
Dakota	2,133	1.9	400.10	413.00	61.6
Iowa	6,968	6.1	802.62	764.10	29.0
Nebraska	2,494	2.2	221.06	323.73	28.0
Kansas	2,265	2.0	211.33	208.56	22.8
Missouri	4,500	4.0	293.54	242.35	13.5
Indian Territory	350	3	65.00	6.00	25.4
Arkansas	1,533	1.4	499.50	143.50	72.3
Texas	6,007	5.3	1,080.54	1,669.40	84.4
Colorado	2,772	2.5	579.41	616.98	75.9
New Mexico	1,076	1.0	41.68	289.37	44.4
Wyoming	613	5	48.71	64.00	22.5
Idaho	472	4	216.30	69.00	156.8
Utah	967	9	185.32	35.00	29.5
Montana	659	6	391.50	157.00	498.6
Nevada	948	8	53.50	156.00	28.4
California	2,643	2.03	327.89	114.40	20.1
Arizona	765	7	216.18	148.30	90.9
Oregon	807	7	180.00	66.00	43.9
Washington	434	4	....	183.50	73.4
Grand total	113,329	100.0	11,590.93	9,789.23	23.3

MARKET PRICES OF FARM PRODUCTS.

The prices of the crops in the tables of estimates are those of the farm. The market prices here given are those of New York, Chicago, and other principal city markets. Necessarily they are higher, by reason of freights and commissions, than home prices. During 1882 and 1883, these records show high rates generally, from several causes. First, the six years of high production, which was quite general and comparatively uniform, have been followed by three years of fruitfulness below an average. Second, the general prosperity of the country, and the ascending scale of values incident to flush times, help to sustain the current rates for farm products. As to meat products, to the scarcity of corn has been added an enlarged foreign demand, and losses from the hard winter of 1880-'81 on the plains.

A striking difference exists between these recent prices of corn and those of 1878 to 1881. From June of the former year to June of the latter, Chicago quotations scarcely touched 40 cents per bushel, and in December of 1878 were recorded at 28 to $31\frac{1}{4}$ cents. Prior to these years of fat kine and swine, the range of prices was wide, touching 81 to 86 cents in October, 1874, the highest point reached in Chicago in ten years. The price was higher at the beginning of 1882 than in December, the under-medium crop of that year being better than the very poor preceding one, and it is lower still at the end of 1883, falling from 59 @ 62 to $51\frac{1}{4}$ @ 55.

The wheat prices are not higher than in former years. The foreign demand has been somewhat less.

Table showing the prices of beef cattle in Chicago at the beginning of each month named.

Date.	Extra.	Choice.	Good.	Medium.	Veals.
1882.					
January	$6 50 to $6 85	$5 85 to $6 35	$5 50 to $5 75	$4 50 to $5 15	$3 50 to $7 50
February	6 30 to 6 50	5 85 to 6 10	5 25 to 5 50	4 50 to 5 00	3 50 to 7 50
March	6 60 to 6 75	5 90 to 6 35	5 50 to 5 75	5 25 to 5 40	3 50 to 7 50
April	6 70 to 6 85	6 00 to 6 40	6 00 to 6 15	5 75 to 6 20	3 75 to 7 20
May	7 60 to 7 85	7 30 to 7 50	6 90 to 7 15	6 50 to 6 75	4 50 to 7 75
June	8 75 to 9 00	8 40 to 8 60	7 75 to 8 25	7 00 to 7 50	5 00 to 8 75
July	8 00 to 8 25	7 65 to 7 85	7 00 to 7 40	5 75 to 6 75	4 00 to 7 75
August	7 50 to 7 75	6 90 to 7 15	6 00 to 6 65	4 50 to 5 75	3 75 to 7 50
September	7 60 to 7 75	7 00 to 7 75	6 00 to 6 75	4 75 to 5 75	4 00 to 7 75
October	7 25 to 7 50	6 75 to 7 00	5 75 to 6 25	4 25 to 5 35	4 50 to 7 50
November	— to —	6 00 to 6 50	5 25 to 5 75	4 50 to 5 00	4 50 to 7 50
December	— to —	5 85 to 6 25	5 00 to 5 50	4 25 to 4 75	4 50 to 7 50
1883.					
January	6 25 to 6 50	5 80 to 6 10	5 40 to 5 70	4 40 to 5 00	4 50 to 7 50
February	6 25 to 6 50	5 75 to 6 05	5 35 to 5 70	4 50 to 5 15	4 50 to 4 75
March	6 25 to 6 50	5 75 to 6 00	5 35 to 5 65	4 90 to 5 15	4 50 to 7 50
April	7 00 to 7 35	6 75 to 6 90	6 35 to 5 65	5 85 to 6 15	4 50 to 7 50
May	6 75 to 7 20	6 50 to 6 70	6 00 to 6 20	5 70 to 6 00	4 00 to 6 90
June	6 20 to 6 35	6 00 to 6 10	5 75 to 5 90	5 50 to 5 70	3 75 to 5 25
July	6 20 to 6 35	6 00 to 6 10	5 70 to 5 80	5 00 to 5 70	3 75 to 5 50
August	6 20 to 6 30	5 90 to 6 10	5 50 to 5 80	4 75 to 5 76	4 00 to 7 50
September	6 25 to 6 40	5 90 to 6 15	5 50 to 5 75	4 50 to 5 25	3 50 to 7 25
October	6 40 to 6 50	6 00 to 6 25	5 50 to 5 75	4 40 to 5 25	3 75 to 7 25
November	6 75 to 7 00	6 25 to 6 60	5 50 to 6 00	4 25 to 5 25	3 75 to 7 25
December	6 50 to 6 55	6 00 to 6 40	5 25 to 5 75	4 25 to 5 20	3 00 to 7 25

The uncertainty of corn production, which always exists in the planting season to some extent, and especially in cold and wet springs, like those of the past two years, is conspicuously exhibited in the April, May, and June records of these years, which are uniformly higher than those of any other months. "Extra" and "choice" beeves averaged lower in 1883 than in 1882. There was less difference in the "good" and "medium" grades. As a whole, prices of Chicago beeves are close to those of two years ago.

MARKET PRICES OF FARM

The following quotations represent as nearly as possible the state

Product.	January.	February.	March.	April.	May.
NEW YORK.					
Flour:					
Superfine ....bbl.	\$3 50 to \$4 45	\$4 35 to \$4 75	\$3 75 to \$4 25	\$3 80 to \$4 45	\$4 10 to \$5 30
Spring wheat extras..do.	4 65 to 5 55	5 20 to 5 75	4 50 to 4 90	4 50 to 5 10	4 90 to 5 45
Winter wheat extras..do.	6 00 to 7 00	5 60 to 7 40	6 00 to 6 75	6 00 to 7 25	6 20 to 7 50
Patents ....do.	6 25 to 8 15	6 60 to 8 80	6 10 to 8 50	6 10 to 8 90	6 80 to 9 25
Wheat:					
No. 2 white.........bush.	1 37	1 38	1 25		1 40
No. 2 red winter.......do.	1 43 to 1 43½	1 44½	1 31¼ to 1 32	1 42½ to 1 43	1 47¾ to 1 48¼
Corn:					
No. 2 mixed.........bush.	70 to 70½	68⅞ to 69½	67¾ to 68	83 to 83¼	82½
Ungraded mixed......do.	67 to 71	64 to 70	64 to 68	81 to 83	82 to 83
Barley ....do.	88½ to 1 15	90 to 1 18	89 to 1 12	1 00 to 1 25	1 12 to 1 17
Oats ....do.	50 to 56½	42 to 51	44 to 52	60 to 65½	58 to 62¾
Rye.....................do.	92 to 97	93	85 to 90	89 to 90	94½
Potatoes ....bbl.	2 00 to 3 50	2 25 to 3 75	2 75 to 3 75	1 75 to 4 25	2 00 to 4 50
Hay:					
First quality.........ton.	20 00 to 22 00	20 00 to 21 00	19 00 to 20 00	18 00 to 20 00	18 00 to 20 00
Second quality........do.	16 00 to 18 00	16 00 to 18 00	16 00 to 18 00	16 00 to 17 00	16 00 to 17 00
Beef:					
Plain mess...........bbl.	....	....	....	10 75 to 12 00	....
Extra mess ....do.	12 00	12 00	12 50 to 13 00	11 75 to 12 00	12 00 to 13 00
Hams ....do.	21 00 to 22 00	20 50 to 21 50	20 50 to 21 50	22 00 to 22 50	23 00 to 25 50
Pork:					
Extra prime ....bbl.	13 50 to 14 00	13 50 to 14 00	13 50 to 13 75	13 50 to 14 00	15 50 to 16 50
Prime mess...........do.	16 00 to 16 50	16 25 to 16 50	16 00 to 16 50	16 00 to 16 75	17 50 to 18 00
Lard ....cental.	11 15 to 11 60	10 60 to 11 70	10 20 to 10 87½	10 40 to 11 65	10 70 to 11 60
Butter:					
Creamery ....lb.	32 to 45	31 to 44	29 to 45	30 to 45	22 to 33
State dairy............do.	31 to 34	32 to 33	37 to 43	35 to 42	23 to 29
Western dairy.........do.	20 to 22	12 to 24	13 to 20	13 to 22	10 to 27
Cheese:					
State factory...........lb.	9 to 13	9 to 13½	8½ to 13	8½ to 13½	8½ to 12
Western factory ......do.	8 to 12½	8	8 to 12½	8 to 11	6 to 12
Sugar, fair to good refining ....lb.	7⅜ to 7½	6⅞ to 7¾	7¼	7¼ to 8¼	7⅜ to 7½
Cotton:					
Ordinary to good ordinary.................lb.	9 3/16 to 10⅞	9 5/16 to 10 15/16	9 1/16 to 10 11/16	9⅜ to 11	9 9/16 to 11 3/16
Low middling to good middling...............lb.	11 7/16 to 12 9/16	11 9/16 to 12⅝	11 [illegible]/16 to 12⅜	11⅝ to 12 11/16	11 13/16 to 12⅞
Tobacco:					
New England, common to fine leaf ....lb.	13 to 35	15 to 35	15 to 35	15 to 35	15 to 35
Pennsylvania, fair to fine leaf ....lb.	14 to 35	13 to 22	11 to 22	11 to 15	13 to 22
New York, common to good leaf ....lb.	8 to 12½	8 to 18	8 to 18	8 to 18	8 to 18
Wisconsin, assorted lots.................lb.	6 to 10	6 to 10	6 to 10	7½ to 11	6½ to 10
Kentucky, common to good, leaf...........lb.	7¾ to 12	7¾ to 10	7¾ to 12⅝	7¾ to 13½	7¾ to 12
Kentucky, common to good, lugs .... lb.	6½ to 8	6½ to 8	6½ to 8	6¼ to 8	6¼ to 8
Virginia, common to fine, leaf ....lb.	8 to 10	8 to 10	8 to 10	8 to 10	8 to 11
Virginia, common to fine, lugs ....lb.	6 to 9	6	6 to 7	6	6 to 9
Wool:					
American XXX and pick-lock ....lb.	44 to 45	45 to 46	45 to 46	45 to 46	45 to 46
American XX to X....do.	37 to 45	37 to 45	37 to 43	36 to 44	36 to 44
American combing and delaine ....do.	42 to 40	42 to 50	39 to 48	40 to 47	40 to 47
Pulled ....do.	20 to 40	20 to 40	20 to 40	18 to 42	18 to 42
California ....do.	12 to 34	12 to 34	12 to 35	12 to 32	12 to 32
BOSTON.					
Flour:					
Western superfine, spring ....bbl.	4 50 to 5 00	4 50 to 5 00	4 25 to 4 75	4 25 to 4 75	4 25 to 4 75
Common extras ....do.	5 50 to 6 00	5 25 to 5 75	5 00 to 5 50	5 00 to 5 75	5 25 to 5 75
Patents, winter wheat.do.	7 25 to 8 25	7 00 to 8 00	7 00 to 8 00	7 00 to 8 00	7 50 to 8 50
Wheat:					
No. 2, white ....bush.	1 36 to 1 37	1 40 to 1 41	....	1 36 to	....
No. 2, red.............. do.	1 40½ to 1 41	1 48 to 1 48½	1 31 to 1 31½	1 43 to 1 44	1 49 to 1 50
Rye ....do.	1 00	97 to 1 00	97 to 1 00	95	1 00
Barley ....do.	95 to 1 15	95 to 1 15	90 to 1 15	1 00 to 1 25	1 00 to 1 25

PRODUCTS FOR 1882.

of the markets at the beginning of each month.

June.	July.	August.	September.	October.	November.	December.
$3 50 to $4 75	$3 30 to $4 35	$3 40 to $4 30	$3 75 to $4 25	$3 50 to $4 05	$3 00 to $3 85	$2 95 to $3 85
4 25 to 4 80	4 45 to 4 60	4 40 to 4 80	4 40 to 4 70	4 15 to 4 40	3 90 to 4 30	3 90 to 4 20
5 85 to 7 15	5 00 to 6 00	5 30 to 5 75	5 00 to 5 45	4 75 to 5 35	5 00 to 5 65	4 70 to 5 40
7 00 to 9 50	6 00 to 9 00	5 75 to 9 00	6 50 to 8 00	6 25 to 7 50	5 75 to 7 30	5 50 to 7 20
....	1 26 to 1 27	1 17	1 13	1 08 to 1 08¼	1 04	98 to 99
1 46 to 1 46¼	1 33¼ to 1 34	1 15¼ to 1 16	1 09⅞ to 1 10¼	1 08½ to 1 09	1 07 to 1 08	1 08⅜ to 1 09
81½ to 84	81¾	86½ to 87	89	72½	84 to 87	82½ to 87
80 to 81	72 to 80	83 to 86	85 to 88	68 to 73	87 to 87½	50 to 77
....	....	1 00	1 00	94 to 1 08	85 to 95	80 to 1 00
57 to 67	55 to 68	57 to 79	55 to 48	38 to 53	41 to 55	40 to 50½
88	82	74 to 77	79	68½	74 to 76½	70 to 70½
3 00 to 7 75	....	2 00	2 00 to 2 50	1 50 to 2 50	1 75 to 3 00	1 87½ to 3 00
19 00 to 20 00	19 00 to 20 00	19 00 to 20 00	19 00 to 20 00	18 00 to 19 00	17 00 to 18 00	17 00 to 18 00
17 00 to 18 00	17 00 to 18 00	17 00 to 18 00	16 00 to 17 00	15 00 to 16 00	14 00 to 16 00	14 00 to 16 00
....	....	....	....	12 50 to 13 50	11 75 to 12 50	12 00 to 13 00
15 00 to 15 90	15 00 to 15 50	15 00 to 15 75	15 00 to 15 75	14 50 to 15 50	13 00 to 14 00	13 00 to 14 00
23 50 to 27 00	25 00 to 27 00	21 00 to 22 00	19 00 to 20 00	17 00 to 18 50	16 80 to 18 50	17 50 to 18 50
17 00 to 17 50	19 00 to 19 50	19 00	19 00 to 20 00	20 00 to 21 00	20 00	18 00
18 50 to 19 50	20 00 to 21 00	21 00	21 00 to 22 00	21 00 to 22 00	21 00	19 00
11 00 to 11 80	11 50 to 12 75	11 75 to 12 95	11 75 to 12 90	12 50 to 13 15	11 75 to 12 80	10 75 to 11 75
18 to 25	18 to 25	18 to 25	20 to 32	20 to 34	24 to 37	24 to 37
20 to 24	20 to 24	20 to 25	23 to 28	25 to 30	27 to 33	27 to 32
14 to 20	14 to 21	14 to 20	14 to 22	15 to 22	18 to 28	18 to 28
5 to 11½	5 to 11	5 to 11	5 to 11½	8 to 12½	9 to 13	9 to 13
7 to 10½	10 to 18	4½ to 10	10 to 19	....	....	....
7⅜ to 8½	7¼ to 7⅜	7¼ to 7⅜	7⅛ to 7¼	7¼ to 7⅜	7⅜ to 7½	7¼ to 7⅜
9½ to 11⅛	9 15/16 to 11 9/16	10 11/16 to 12¼	10 7/16 to 12	8⅞ to 10⅜	7 15/16 to 9 7/16	7⅞ to 9⅜
11¾ to 12 13/16	12 3/16 to 13¼	12¼ to 13¾	12½ to 13½	11 to 11 9/16	10 1/16 to 10 15/16	10 to 10⅞
15 to 35	15 to 35	15 to 35	15 to 35	16 to 35	16 to 35	14 to 35
13 to 22	13 to 23	13 to 22	13 to 22	13 to 22	13 to 22	12 to 25
8 to 18	8 to 18	8 to 18	8 to 18	4½ to 18	4½ to 18	8 to 15
6½ to 10	6½ to 9	6½ to 10	6½ to 10	6½ to 10	6½ to 10	6½ to 10
7 to 13	7 to 12	7 to 12	7 to 12	7 to 12	7 to 12	6⅜ to 12
6 to 7½	6 to 7½	5¾ to 7¾	5¾ to 7¼	5¼ to 7¼	5¾ to 7½	5½ to 7
8 to 11	8 to 11	8 to 11	8 to 11	8 to 12	8 to 12	8 to 12
6 to 9	6 to 9	6 to 9	6 to 9	5½ to 9	5½ to 9	5½ to 9
45 to 46	45 to 46	45 to 46	45 to 46	45 to 46	45 to 46	45 to 46
35 to 43	35 to 43	35 to 43	35 to 42	35	35 to 42	35 to 42
34 to 46	34 to 46	34 to 46	34 to 47	34 to 42	34 to 47	34 to 49
18 to 44	18 to 42	18 to 42	18 to 42	18 to 42	14 to 40	18 to 40
12 to 34	12 to 34	12 to 34	12 to 31	12 to 32	12 to 32	12 to 31
4 00 to 4 50	3 50 to 4 00	3 50 to 4 25	3 50 to 4 00	3 75 to 4 00	3 50 to 3 90	3 25 to 3 75
4 75 to 5 75	4 50 to 5 50	4 50 to 5 00	4 50 to 5 00	4 50 to 5 00	4 00 to 4 50	3 75 to 4 25
7 50 to 8 25	6 50 to 8 50	6 50 to 7 50	6 50 to 7 25	6 00 to 7 00	6 25 to 7 25	6 00 to 6 75
1 40 to 1 41	....	1 17 to 1 18	1 15 to 1 16	1 09 to 1 10	1 04 to 1 05	98 to 99
1 45 to 1 46	1 44 to 1 45⅜	1 13 to 1 14	1 12 to 1 13	1 05 to 1 06	1 08½ to 1 09	1 09½ to 1 10
98 to 1 00	95	85 to 90	85 to 90	80 to 85	80 to 85	74 to 75
1 00 to 1 25	1 00 to 1 25	1 10 to 1 35	1 10 to 1 35	1 10 to 1 35	80 to 1 05	80 to 1 05

MARKET PRICES OF FARM

Product.	January.	February.	March.	April.	May.
BOSTON—Continued.					
Oats:					
No. 2, white ....bush.	$0 53¼ to $0 54	$0 54 to $0 54½	$0 53 to $0 53½	$0 58	$0 63 to $0 64
No. 2, mixed ....do.	51 to 52	51 to 51½	50 to 51	55	58 to 60
Corn, No. 2, mixed.......do.	72 to 72½	73 to 74	73 to 74	$0 83 to 84	88 to 89
Potatoes ....do.	70 to 1 05	90 to 1 20	80 to 1 15	65 to 1 15	80 to 1 25
Hay:					
Good..................ton.	16 00 to 18 00	16 00 to 18 00	16 00 to 18 00	16 00 to 18 00	16 00 to 18 00
Choice ....do.	20 00 to 21 00	20 00 to 21 00	19 00 to 21 00	20 00 to 21 00	20 00 to 21 00
Pork:					
Extra prime ....bbl.	15 00 to 15 50	14 50 to 15 50	14 50 to 15 00	14 25 to 14 75	15 50 to 16 00
New mess ....do.	18 00 to 18 50	18 50	18 00 to 18 50	17 75 to 18 00	19 00 to 19 25
Beef:					
Western, extra.......bbl.	12 00 to 13 00	11 00 to 11 50	9 50 to 10 50	11 50 to 12 50	....
Family, extra and plate, barrel	14 50 to 15 00	14 00 to 15 00	13 00 to 15 00	13 00 to 15 00	15 00 to 16 00
Lard ....lb.	11½ to 11¾	11½ to 11¾	11⅜ to 11⅝	11¼ to 11¾	11¾ to 12½
Butter:					
Northern creamery....lb.	25 to 36	25 to 36	30 to 42	....	29 to 30
Western ....do.	28 to 40	28 to 40	38 to 46	35 to 44	26 to 31
Cheese:					
Northern factory, good to choice ....lb.	12½ to 13	11 to 13¾	11 to 13½	10 to 14	12 to 14½
Western factory, good to choice ....lb.	10 to 13	10 to 13	10 to 13	10 to 13½	10 to 13½
Sugar, fair to good, refining ....lb.	7⅜ to 7½	7⅛ to 7¼	7⅛ to 7¼	7¼ to 7⅜	7⅜ to 7½
Cotton:					
Ordinary to good ordinary ....lb.	9⅜ to 9⅝	9⅜ to 11	9 to 10⅝	9⅝ to 11⅛	9⅝ to 11¼
Middling to middling fair.....................lb.	12½ to 13½	12½ to 13½	11¾ to 13½	12¼ to 13⅝	12⅜ to 13¾
Tobacco:					
Choice leaf............lb.	14 to 15	14	14	13 to 16	13 to 16
Good western.........do.	10½ to 16	10½ to 16	10½ to 16	10 to 13	10 to 13
Lugs...................do.	7 to 8½	9 to 10½	7½ to 8½	6 to 8	6 to 8
Wool:					
Pick-lock and X. X. X .lb.	47 to 48	47 to 48	46 to 48	44 to 47	43 to 46
Pulled ....do.	15 to 43	15 to 44	15 to 44	15 to 50	15 to 44
Combing and delaine..do.	25 to 50	25 to 50	25 to 50	23 to 48	22 to 48
PHILADELPHIA.					
Flour:					
Superfine, Western and Pennsylvania......bbl.	4 25 to 4 50	3 75 to 5 00	3 75 to 4 75	3 75 to 4 25	3 75 to 4 00
Bakers', Minn., straight, barrel....................	7 00 to 7 25	7 00 to 7 37½	6 62½ to 7 00	7 25 to 7 40	7 50 to 7 75
Patents, winter wheat, bbl.	7 50 to 8 00	7 50 to 8 25	7 50 to 7 75	7 75 to 8 25	7 75 to 8 50
Patents, spring wheat.do.	7 50 to 8 40	7 50 to 8 25	7 50 to 7 75	7 75 to 8 50	8 00 to 9 00
Wheat:					
No. 2, red .... bush.	1 40 to 1 41	1 42½	1 33	1 36¼ to 1 37	1 45 to 1 45½
Amber...................do	1 43 to 1 44	....	....	....	....
Barley ....do.	84 to 1 18	90 to 1 18	70 to 1 30	70 to 1 30	95 to 1 25
Corn, sail, mixed........do.	69½	69	67 to 68	81	85 to 86½
Oats, No. 2 white ....do.	52	49 to 50½	50½	59 to 59½	61 to 61½
Rye.......................do	97	90 to 92	85	86	90 to 94
Potatoes ....do.	80 to 1 12	1 10 to 1 25	1 12 to 1 23	40 to 1 20	70 to 1 45
Hay, timothy ....ton.	18 00 to 19 50	18 00 to 20 00	16 00 to 18 00	17 00 to 19 00	17 00 to 19 00
Beef:					
Family................bbl.	13 50 to 14 00	13 50 to 14 00	13 50 to 14 00	14 00	15 50
India mess..............do.	25 00 to 25 50	25 50	26 00	25 00 to 26 00	27 00
Hams...................do.	20 50 to 21 50	21 00 to 22 00	22 00 to 22 50	21 00 to 23 00	23 50 to 26 00
Pork:					
Mess..................bbl.	17 50 to 18 00	18 50	18 25 to 18 75	18 50 to 19 00	19 00 to 19 50
Prime mess............do.	13 50	17 00	17 00 to 17 75	17 50 to 17 75	18 00 to 18 50
Lard ....cental.	11 30 to 11 75	11 87½ to 12 00	10 62½ to 11 50	11 25 to 11 75	11 62½ to 12 00
Butter:					
Creamery ....lb.	35 to 41	35 to 43	39 to 45	39 to 44	28 to 32
Western dairy ....do.	27 to 31	24 to 33	30 to 35	33 to 39	22 to 25
Cheese:					
New York factory.....lb.	12 to 13½	12 to 13	12 to 13	12 to 13¼	11½ to 13
Ohio .... do.	11½ to 13	12¾ to 13	11 to 12½	11 to 12¼	11½ to 12½
Sugar:					
Fair to good refining ..lb.	7 7/16 to 7 9/16	6⅞ to 7	7¼ to 7⅜	7 5/16 to 7 7/16	7⅜ to 7½
Cotton:					
Ordinary to good ordinary..................lb.	9⅜ to 10⅝	9½ to 11½	9¼ to 11½	9⅝ to 11⅝	9¾ to 11⅛
Low middling to good middling ....lb.	11⅜ to 12⅝	11½ to 12¾	11¼ to 12½	11⅝ to 12⅞	11¾ to 13

PRODUCTS FOR 1882—Continued.

June.	July.	August.	September.	October.	November.	December.
$0 64½ to $0 65	$0 66½ to $0 67	$0 69 to $0 70	$0 53 to $0 54	$0 48 to $0 48½	$0 49 to $0 50	$0 52 to $0 53
61 to 62	63	66 to 67	50 to 52	38 to 44	43 to 47	44 to 48
87 to 88	88 to 89	90 to 91	91 to 92	78 to 79	87 to 88	89 to 90
1 25 to 1 50	90 to 1 20	....	90 to 1 00	60 to 80	60 to 70	60 to 80
18 00 to 20 00	18 00 to 19 00	18 00 to 19 00	18 00 to 19 00	18 00 to 19 00	18 00 to 19 00	18 00
21 00 to 22 00	20 00 to 21 00	20 00 to 21 00	20 00 to 21 00	18 00 to 21 00	16 00 to 17 00	16 00 to 17 00
17 00 to 18 00	17 50 to 18 00	19 50 to 20 00	20 00 to 21 00	21 00 to 21 50	21 00 to 21 50	17 50 to 18 00
20 50 to 21 00	21 50 to 22 00	22 25 to 22 50	22 75 to 23 00	22 50 to 22 75	23 50 to 23 75	20 00 to 20 50
15 00 to 16 00	15 00 to 16 00	15 50 to 16 00	15 50 to 16 00	14 50 to 15 00	13 50 to 14 00	12 50 to 13 00
18 00 to 20 00	18 00 to 20 00	18 00 to 20 00	18 00 to 19 00	17 50 to 18 00	15 00 to 18 00	15 00 to 16 00
12 to 12½	12¼ to 12¾	13 to 13½	12⅞ to 13¼	13 to 13¼	13¼ to 13½	12½ to 12¾
22 to 26	21 to 26	21 to 26	24 to 30	24 to 31	28 to 37	28 to 36
22 to 26	21 to 26	20 to 25	23 to 30	20 to 31	23 to 36	23 to 36
....	....	9 to 11	....	10 to 12½	10 to 13	9 to 13½
....	....	8 to 10¼	8 to 11	8 to 11¾	9 to 13	9 to 12½
7¼ to 7⅜	7¼ to 7⅜	7¼ to 7⅜	7 3/16 to 7 5/16	7½ to 7⅝	7⅜ to 7½	7 3/16 to 7 5/16
9½ to 11½	10 to 11⅝	10¼ to 11⅞	10⅝ to 12⅛	9¼ to 10¾	8 to 9½	7⅞ to 9⅜
12½ to 13½	12¾ to 14½	12⅞ to 14¼	13 to 14⅝	11⅝ to 12¼	10½ to 11¾	10½ to 11⅝
13 to 16	13 to 16	13 to 16	13 to 16	13 to 16	13 to 16	13 to 16
10 to 13	10 to 13	10 to 13	10 to 13	10 to 13	10 to 13	10 to 13
6 to 8	6 to 8	6 to 8	6 to 8	6 to 8	6 to 8	6 to 8
44 to 46	44 to 45	43 to 45	43 to 45	47 to 50	45 to 50	45 to 46
15 to 47	15 to 50	15 to 47	15 to 45	15 to 47	15 to 45	15 to 45
20 to 48	20 to 47	20 to 47	20 to 49	20 to 50	20 to 50	20 to 48
3 50 to 4 00	2 87½ to 3 25	2 75 to 3 00	2 75 to 3 00	2 75 to 3 00	3 00 to 3 37½	3 00 to 3 37½
7 25 to 7 50	6 90 to 7 25	6 50 to 7 25	7 00 to 7 50	6 50 to 6 75	6 25 to 6 50	5 50 to 6 00
7 75 to 8 50	7 25 to 8 25	7 00 to 8 00	6 75 to 7 75	6 25 to 7 00	6 37½ to 7 00	6 00 to 7 00
8 00 to 9 00	7 50 to 8 50	7 25 to 8 50	8 00 to 8 50	7 25 to 8 00	7 00 to 7 75	6 75 to 7 75
1 40¾ to 1 42½	1 37	1 47 to 1 47½	1 13	1 07	1 08 to 1 09	1 08¼ to 1 08¾
95 to 1 25	70 to 1 25	1 00 to 1 35	1 00 to 1 35	85 to 1 10	70 to 1 10	70 to 1 05
83½ to 84½	79½ to 80	90 to 91	86½	68½ to 70	89 to 90	82⅝ to 87
61½ to 62½	61¾ to 62	69 to 70	58 to 66	45	45 to 46	48¾ to 49
90 to 91	80	65	Nominal.	68 to 70	73 to 75	67 to 68
1 50 to 1 75	....	....	90 to 1 00	57 to 68	65 to 70	75 to 88
18 00 to 21 00	15 00 to 18 00	15 00 to 20 00	15 00 to 18 00	14 00 to 18 00	15 00 to 17 50	14 00 to 16 50
20 00	20 00	20 00	19 00	18 00 to 18 50	17 00 to 17 50	17 00
24 00 to 26 00	24 00 to 26 00	22 00 to 23 00	21 00 to 22 00	17 50 to 18 50	18 00 to 19 50	18 00 to 19 00
20 75 to 21 00	22 00 to 22 50	22 50 to 23 00	23 00 to 23 50	23 75 to 24 00	24 00	20 00 to 20 50
20 00 to 20 50	20 00 to 20 50	.... 21 00	21 50 to 22 00	22 50 to 23 00	22 50 to 23 00	.... 20 00
11 75 to 12 50	12 50 to 13 00	12 87½ to 13 25	13 00 to 13 50	13 50 to 13 75	12 50 to 13 25	11 75 to 12 50
21 to 25	23 to 26	23 to 26	26 to 29	27 to 33	33 to 37	33 to 38
14 to 20	16 to 22	16 to 22	16 to 22	20 to 26	23 to 30	23 to 30
11 to 12	10 to 11½	10¾ to 11½	10¼ to 11½	11 to 13	12¼ to 13¼	12½ to 13¼
10 to 11	8½ to 9½	9 to 10	9 to 10¾	10½ to 12	11¾ to 13	11½ to 13
7 5/16 to 7 7/16	7¼ to 7⅜	7¼ to 7⅜	7 3/16 to 7 5/16	7 7/16 to 7 9/16	7⅜ to 7½	7 3/16 to 7 5/16
9⅞ to 11¼	10⅜ to 11¾	10⅝ to 12	10¾ to 12⅛	9⅛ to 10½	8⅜ to 9¾	8¼ to 9⅝
12 to 13⅛	12½ to 13½	12⅞ to 13⅞	12⅞ to 13⅞	11¼ to 12¼	10⅞ to 11⅛	10⅞ to 11⅞

MARKET PRICES OF FARM

Product.	January.	February.	March.	April.	May.
PHILADELPHIA—Cont'd.					
Wool:					
Ohio X to XX.........lb.	$0 43 to $0 46	$0 44½ to $0 45	$0 43 to $0 45	$0 40 to $0 43½	$0 45 to $0 47
Ohio combing.........do.	40 to 52	50	45	44 to 45	43 to 49
Unwashed delaine ....do.	30 to 36	....	37	39	33½
Unwashed combing...do.	26 to 28	28 to 36	27½ to 34	27 to 31	23 to 26½
Tobacco:					
State seed wrappers...lb.	12½ to 20	12½ to 20	12½ to 20	12½ to 20	12½ to 20
Pennsylvania assorted leaf ....lb.	18 to 25	18 to 25	18 to 25	18 to 25	18 to 25
Ohio running lot, fair..do.	9 to 13	9 to 13	9 to 13	9 to 13	9 to 13
Ohio running lot, good, do.	13 to 18	13 to 18	13 to 18	13 to 18	13 to 18
Kentucky common to good lugs ....lb.	5 to 10	5 to 10	5 to 10	5 to 10	5 to 10
Kentucky good to fine leaf ....lb.	12 to 30	12 to 30	12 to 30	12 to 30	12 to 30
BALTIMORE.					
Flour:					
State superfine.......bbl.	4 00 to 4 80	4 00 to 4 75	3 50 to 4 50	3 50 to 4 75	3 75 to 5 00
Ohio and Indiana superfine ....bbl.	4 00 to 4 80	4 00 to 4 75	3 50 to 4 50	3 50 to 4 00	3 75 to 5 00
Western family......do..	7 25 to 7 75	7 25 to 7 50	6 15 to 7 20	6 37½ to 6 75	6 45 to 7 35
Patents............. do..	7 25 to 8 75	7 50 to 8 75	7 50 to 8 50	6 85 to 7 50	8 00 to 8 25
Wheat, No. 2 red.....bush.	1 30	1 35	1 28⅜ to 1 29	1 35¼ to 1 35½	1 41½ to 1 42
Corn, regular mixed...do..	66 to 67	66½ to 68½	68	75 to 77	80 to 81½
Rye.....................do..	94½	94½ to 95½	95	93 to 1 00	95 to 98
Oats ....do..	47 to 50	47 to 52	48 to 51	54 to 58	55 to 58
Potatoes ....do..	1 00 to 1 20	1 00 to 1 25	1 15 to 1 25	1 20 to 1 35	1 10 to 1 30
Hay, timothy..........ton.	16 00 to 22 50	16 00 to 22 00	15 00 to 20 00	15 00 to 21 00	16 00 to 20 00
Pork:					
Mess...................bbl.	18 00 to 18 75	18 50 to 18 75	17 75 to 18 25	17 75 to 18 50	18 50 to 19 50
Bacon shoulders.......lb.	8½	8½	8½	8⅝	9½
Sugar-cured hams, canvassed ....lb.	13 to 14	13 to 14	13 to 13¾	13½	to 14½
Sugar-cured shoulders.do.	9½	9½	9½	9½	10½
Lard ....cental.	12 00	12 50	12 50	11 50 to 12 00	12 75
Butter:					
Creamery.............lb..	37 to 44	37 to 45	35 to 48	41 to 46	28 32
New York State, choice to fine...............lb.	31 to 40	30 to 41	30 to 42	30 to 42	25 to 30
Western factory......do.	28 to 36	28 to 35	28 to 35	30 to 38	17 to 26
Cheese:					
New York factory....lb.	12½ to 13	12½ to 12¾	12½ to 13¾	12½ to 13¾	14 to 14½
Western................do.	6 to 12	6 to 13¼	6 to 12½	5 to 13	8½ to 10
Sugar, fair refining.....do.	7 to 8	7	7¼	7¼	7⅛ to 7½
Cotton:					
Ordinary to good ordinary.................lb.	9 to 10	9 to 10¼	8¾ to 10½	9¼ to 10½	9½ to 10¾
Low middling to middling.................lb.	11⅜	11⅝	11¼ to 11½	11½ to 12⅛	11¾ to 12¼
Tobacco:					
Good to medium Maryland leaf ....cental.	5 25 to 8 00	5 00 to 8 00	5 00 to 8 00	5 00 to 8 00	5 00 to 8 00
Common to medium Kentucky leaf .....cental.	7 50 to 10 00	7 50 to 10 00	7 50 to 10 00	7 50 to 10 00	7 50 to 10 00
Common to good Kentucky lugs.....cental.	5 00 to 7 00	5 00 to 7 00	5 00 to 7 00	5 00 to 7 00	5 00 to 7 00
Common to good Virginia lugs......cental.	3 00 to 5 50	3 00 to 5 50	3 00 to 5 50	3 00 to 5 50	3 00 to 5 50
Wool:					
Burry ....lb.	17 to 24	17 to 24	17 to 24	17 to 24	17 to 24
Merino, unwashed ...do.	21 to 23	21 to 23	21 to 23	21 to 23	21 to 23
Good unwashed.......do.	26 to 29	26 to 29	26 to 29	26 to 29	27 to 29
Tub-washed...........do.	36 to 40	36 to 40	36 to 40	36 to 40	36 to 40
Rice:					
Carolina, common to choice.................lb.	5⅜ to 8	5⅜ to 8	5⅜ to 8	5⅜ to 8	6 to 8
Louisiana, fair to prime, pound	5½ to 7½	5½ to 7½	5½ to 7½	5½ to 6¼	6 to 6¾
CHICAGO.					
Flour:					
Winter ....bbl	5 00 to 6 50	5 80 to 7 05	6 25 to 7 00	6 00 to 7 00	6 00 to 7 00
Spring ....do..	6 00 to 7 00	7 25 to	.... 6 75	....	..........7 50
Wheat:					
No. 2 spring ....bush.	1 27⅞ to 1 27⅝	1 30 to 1 31	1 26¼ to 1 26¾	.... 1 35	.... 1 40
No. 2 winter ....do.	....	....	....	1 12½ to 1 32½	....
Barley ....do..	82 to 1 08	67 to 1 07	61½ to 1 03	78½ to 1 05	75 to 97
Corn, No. 2 ....do..	63¼ to 63½	60¼ to 60¾	60 to 60½	69½ to 70	73½ to 74¼

PRODUCTS FOR 1882—Continued.

June.	July.	August.	September.	October.	November.	December.
$0 42½ to $0 47½	$0 41 to $0 42	$0 41 to $0 43	$0 42 to $0 44	$0 38 to $0 43	$0 41 to $0 43	$0 35 to $0 42
33 to 51	44 to 48	38 to 48	34 to 48	35 to 49	34 to 50	43 to 49
......	......	......	......	......	......	......
26 to 33	21 to 36	22 to 36	21 to 30	21½ to 30	22½ to 36	29 to 35
12½ to 20	12½ to 20	12½ to 20	12½ to 20	12½ to 20	12½ to 20	12½ to 20
18 to 25	18 to 25	18 to 25	18 to 25	18 to 25	18 to 25	18 to 25
9 to 13	9 to 13	9 to 13	9 to 13	9 to 13	9 to 13	9 to 13
13 to 18	13 to 18	13 to 18	13 to 18	13 to 18	13 to 18	13 to 18
5 to 10	5 to 10	5 to 10	5 to 10	5 to 10	5 to 10	5 to 10
12 to 30	12 to 30	12 to 30	12 to 30	12 to 30	12 to 30	12 to 30
3 50 to 4 00	3 25 to 4 00	3 00 to 3 75	3 25 to 3 75	3 25 to 3 50	3 50 to 4 00	3 25 to 3 75
3 25 to 4 30	3 25 to 4 00	3 00 to 3 75	3 25 to 3 75	3 10 to 3 50	3 50 to 4 00	3 25 to 3 75
6 05 to 6 75	5 65 to 6 75	5 25 to 6 75	5 00 to 5 87½	4 62 to 5 50	4 87 to 5 50	4 75 to 5 50
8 00 to 9 00	7 50 to 9 00	7 00 to 8 75	5 75 to 8 50	5 75 to 8 50	5 75 to 8 00	5 75 to 8 00
1 38 to 1 38½	1 55	1 13½ to 1 13¾	1 11 to 1 11¼	1 06 to 1 06¼	1 05¼ to 1 05½	1 05⅞ to 1 06¼
81	81¼	83½ to 84	84	65½ to 67	82 to 87	84
75 to 80	80	65 to 75	65 to 67	72 to 73	66 to 68	65
60 to 61	59 to 62	63 to 66	38 to 45	39 to 45	42 to 47	40 to 46
......	......	2 00 to 2 50	2 00 to 2 50	2 25 to 2 75	2 00 to 2 25	2 00 to 2 30
17 00 to 20 00	15 00 to 19 00	17 00 to 21 00	15 00 to 18 00	15 00 to 19 00	14 00 to 19 00	14 00 to 19 00
20 00 to 21 00	21 50 to 22 75	22 25 to 23 25	24 00	23 25	24 25	22 75
10½	11½	12	12¼	12½	12¾	12¾
15¾ to 16	15½ to 16	15½ to 16¼	15¾ to 16½	16¼ to 17½	16¾ to 17	15½ to 17
11¾	13	13¼	13¼ to 13½	13½	12	12
12 75	12 75	13 25	14 00	14 00	13 75	13 50
22 to 25	20 to 27	23 to 27	25 to 35	25 to 32	25 to 37	28 to 38
20 to 23	20 to 22	18 to 24	20 to 27	20 to 28	25 to 32	28 to 34
18	18 to 20	18 to 20	18 to 20	20 to 22	23 to 25	23 to 26
11½ to 13	11½ to 12½	10⅓ to 12	11 to 12½	11½ to 12½	12 to 13	12½ to 13½
8 to 10½	8 to 10½	8 to 10	9 to 11	10 to 11½	11 to 12½	11 to 12½
7⅛ to 7½	7 to 8¼	7¼ to 7⅜	7 to 7⅝	7½ to 7⅝	7⅛ to 7½	7⅛ to 8⅜
7 to 10⅝	9¾ to 11¼	10 to 11¼	10½ to 11⅞	9½ to 10½	9 to 9¼	8¾ to 9
11½ to 12	12⅛ to 12⅝	12¼ to 12¾	12⅝ to 13	11¼ to 11⅝	10 to 10⅜	9¾ to 10⅜
5 00 to 8 00	5 00 to 8 00	5 00 to 8 00	4 00 to 8 00	4 00 to 8 00	4 00 to 8 00	4 00 to 8 00
7 50 to 10 00	7 50 to 10 00	7 50 to 10 00	7 50 to 10 00	7 50 to 10 00	7 50 to 10 00	7 50 to 10 00
5 00 to 7 00	5 00 to 7 00	5 00 to 7 00	5 00 to 7 00	5 00 to 7 00	5 00 to 7 00	5 00 to 7 00
3 00 to 5 50	3 00 to 5 50	3 00 to 5 50	3 00 to 5 50	3 00 to 5 50	3 00 to 5 50	3 00 to 5 50
......	......	......	......	......	......	......
......	......	......	......	......	......	......
26 to 28	27 to 30	27 to 30	27 to 30	27 to 30	27 to 30	27 to 30
36 to 38	37 to 40	37 to 40	37 to 40	37 to 40	37 to 40	37 to 40
5¾ to 8	5¾ to 8	5¾ to 8	5¾ to 8	5¼ to 7⅛	5½ to 7½	5½ to 7½
5½ to 6¼	5½ to 6¼	5½ to 6¼	5½ to 6½	5 to 6	5 to 6	5 to 6
6 00 to 7 00	6 00 to 7 00	6 00 to 7 00	5 00 to	......	......	......
6 00 to 7 50	6 10 to 7 00	6 50 to 7 10	......	...... 5 75	......	......
1 24¾ to 1 25½	1 15½ to 1 17⅛	98 to 1 02½	1 00½ to 1 02	1 05½ to 1 08	92⅛ to 92¾	94 to 94½
1 20 to 1 22½	1 25 to 1 40	98 to 1 02	99⅝ to 1 02	95½ to 96	94¾ to 95	......
65 to 1 00	55 to 65	75 to 82	71½ to 72½	86½ to 87	82	81 to 82
69 to 71	74¾ to 75	76 to 78½	74¾ to 76	57⅞ to 58⅝	67½ to 68	59 to 62

MARKET PRICES OF FARM

Product.	January.	February.	March.	April.	May.
CHICAGO—Continued.					
Oats, No. 2 ....bush.	$0 44¾ to $0 45	$0 42½ to $0 42¾	$0 40¼ to $0 40⅝	$0 44 to $0 47	$0 53 to $0 53⅜
Rye, No. 2 ....do..	95½ to 97	91 to 96	82 to 88	 86	 83
Potatoes ....do..	80 to 1 10	1 00 to 1 15	1 10 to 1 20	....	1 00 to 1 10
Hay:					
Timothy, 1st quality.ton.	14 50 to 15 00	12 00 to 13 00	12 00 to 13 00	13 00 to 14 00	14 00 to 15 00
Timothy, 2d quality..do..	12 00 to 13 50	10 00 to 11 00	11 00 to 11 50	12 00 to 12 50	13 00 to 14 00
Beef:					
Mess ....bbl.	9 75 to 10 00	10 00 to 10 50	10 00 to 10 50	10 00 to 10 50	11 00 to 11 50
Extra mess ....do.	10 50 to 11 00	11 00 to 11 50	11 00 to 11 50	11 50 to 12 00	12 00 to 12 50
Hams ....do.	20 25 to 20 50	20 50 to 21 00	20 50 to 21 00	20 50 to 21 00	24 00 to 25 00
Pork:					
Mess ....bbl.	17 07½ to 17 20	18 00 to 18 30	16 62½ to 17 00	17 15 to 17 25	18 02½ to 18 25
Bacon ....lb.	7½ to 10	7¾ to 10½	7½ to 10½	7¾ to 11	8½ to 11¾
Hams ....do.	11½ to 12	11½ to 12	11½ to 12	12 to 12½	12½ to 13½
Lard ....cental.	11 15 to 11 20	11 05 to 11 07½	10 37½ to 10 52½	11 00 to 11 05	11 15 to 11 25
Butter:					
Creamery ....lb.	33 to 40	33 to 41	38 to 46	37 to 45	24 to 28
Good to choice dairy..do.	25 to 32	26 to 35	28 to 38	22 to 36	20 to 26
Cheese:					
Full cream ....lb.	11 to 12½	12 to 13	12½ to 13½	12 to 13	13 to 14
Lower grades ....do.	2 to 9¼	2 to 11½	2 to 10	2 to 10	2 to 12½
Sugar, yellow ....do.	7 to 8	7 to 8	7 to 8	7½ to 8½	8 to 8⅝
Wool:					
Good to choice medium tub ....lb.	40 to 44	37 to 42	38 to 43	37 to 41	37 to 38
Fine washed fleece....do.	30 to 40	30 to 38	30 to 40	31 to 43	37 to 49
Fine unwashed fleece..do.	26 to 28	20 to 24	18 to 20	18 to 19	18 to 20
CINCINNATI.					
Flour:					
Superfine ....bbl.	3 90 to 5 00	3 50 to 5 00	3 40 to 4 85	4 25 to 4 75	4 60 to 5 10
Extra ....do..	5 25 to 5 60	5 25 to 5 60	5 20 to 5 50	5 00 to 5 40	5 40 to 5 85
Family ....do..	6 10 to 6 35	6 20 to 6 50	5 90 to 6 25	5 80 to 6 00	6 15 to 6 40
Fancy ....do..	6 65 to 7 50	6 85 to 7 50	6 65 to 7 25	6 50 to 7 00	6 75 to 7 25
Wheat:					
No. 2 red ....bush.	1 38 to 1 39	1 41 to 1 42	1 28 to 1 29	1 33½ to 1 34	1 40 to 1 41
No. 2 hard ....do..	....	....	1 30	....	.... 1 42
Corn:					
No. 2 mixed ....do..	69 to 70½	64½ to 64¾	62¾ to 63¼	72 to 72¼	74¾
No. 2 white ....do..	71	72⅞ to 72½	70¼ to 70½	76½ to 76⅝	79¾ to 80
No. 2 yellow ....do..	....	 65	63¼ to 63½	72	75
Oats ....do..	48 to 50	48 to 50	45 to 49	50 to 51¼	51 to 55½
Rye ....do..	1 03 to 1 05	1 04 to 1 04¾	94 to 95	90½ to 91	92½ to 93
Barley ....do..	90 to 1 05	96 to 1 05	93 to 1 00	96 to 1 00	95 to 1 12
Hay:					
No. 1 timothy ....ton.	17 00 to 18 00	16 00 to 17 00	15 50 to 16 50	17 00 to 18 00	17 00 to 18 00
Lower grades ....do..	14 00 to 16 00	14 00 to 15 00	14 00 to 15 00	15 00 to 16 00	15 00 to 16 00
Pork:					
Mess ....bbl.	17 25 to 17 50	18 50 to 18 75	18 00 to 18 25	18 00 to 18 25	18 75 to 19 00
Hams, sugar-cured ....lb.	11½ to 12½	12½ to 13	12¼ to 13	11¾ to 12½	13 to 13¾
Shoulders ....do.	7¾ to 8	8 to 8¼	8¼ to 8½	8 to 8¼	8¾ to 9
Bacon ....do.	11¼ to 11¾	11½ to 12¼	11½ to 12¼	11½ to 11¾	12¼ to 13
Lard ....cental.	10 92 to 10 97	11 30 to 11 80	10 30 to 10 50	10 40 to 10 95	10 95 to 11 10
Butter:					
Creamery ....lb.	45	43 to 45	50 to 52	44 to 46	30 to 32
Lower grades ....do.	15 to 30	18 to 33	25 to 40	22 to 40	15 to 26
Cheese:					
Choice Ohio factory...lbs.	11½ to 12½	12 to 13	12 to 12½	10 to 12	11 to 12
Lower grades ....do..	....	10½ to 11½	9½ to 11½	8 to 9	8½ to 9
Potatoes ....bush..	1 00 to 1 25	1 15 to 1 30	1 20 to 1 35	1 00 to 1 35	1 15 to 1 55
Peanuts:					
Tennessee ....lb.	4¾ to 6½	5½ to 7½	5½ to 7	5½ to 7¾	5¾ to 7¾
Virginia ....do.	8 to 8¼	8¾ to 9½	8½ to 9	8½ to 9	8½ to 9
Cotton:					
Ordinary to good ordinary ....lb.	8¾ to 10¼	8⅞ to 10⅜	8⅝ to 10⅛	9⅛ to 10⅝	9¼ to 10¾
Low middling to good middling ....lb.	10⅞ to 11⅜	11 to 11⅞	10¾ to 11⅝	11¼ to 12⅛	11⅜ to 12¼
Middling fair to fair...do.	12½ to 13¼	12⅝ to 13⅜	12⅜ to 13⅛	12⅞ to 13⅝	13 to 13¾
Wool:					
Fleece, washed ....lb.	35 to 38	35 to 40	37 to 40	37 to 40	35 to 40
Tub washed ....do.	28 to 39	28 to 39	28 to 38	28 to 38	28 to 30
Unwashed ....do.	18 to 27	18 to 28	18 to 27	18 to 26	17 to 25
Pulled ....do.	29 to 30	29 to 30	28 to 29	28 to 29	28 to 29
SAINT LOUIS.					
Flour, choice ....bbl.	5 40 to 7 50	6 40	6 00 to 6 15	6 10 to 6 25	6 15 to 6 25
Wheat, No. 2 red ....bush.	1 35	1 42¼ to 1 42⅞	1 35¼ to 1 35½	1 27⅛ to 1 27½	1 32½ to 1 33¼

PRODUCTS FOR 1882—Continued.

June.	July.	August.	September.	October.	November.	December.
$0 48 to $0 48½	$0 56 to $0 56½	$0 60 to $0 62	$0 37 to $0 39	$0 35	$0 34 to $0 34½	$0 33 to $0 34
77 to 78	65 to 75	66 to 68	63 to 67	58	50 to 58	58
1 60 to 1 61	....	....	 50	$0 45 to 50	45 to 50	65 to 70
15 00 to 16 00	14 00 to 15 00	14 00 to 15 00	11 00 to 12 00	12 50 to 13 00	11 50 to 12 00	11 50 to 12 50
13 00 to 14 00	11 00 to 12 00	12 00 to 13 00	9 00 to 10 00	10 50 to 12 00	10 00 to 10 50	10 50 to 11 00
12 50 to 13 00	12 50 to 13 00	12 25 to 12 50	12 25 to 12 50	12 25 to 12 50	12 00 to 12 50	10 50 to 10 75
13 50 to 14 00	14 00 to 14 25	12 75 to 13 00	12 50 to 13 00	12 80 to 13 20	....	....
24 50 to 25 00	23 00 to 24 00	19 50 to 20 00	17 50 to 18 00	17 00 to 18 00	....	17 00 to 18 00
19 32½ to 19 47½	21 57½	19 22½ to 21 20	21 82½ to 21 95	22 50 to 22 40	21 00 to 22 00	17 25 to 18 50
10¼ to 12½	11 to 14	10¼ to 14	11 to 15	12 to 13½	....	....
14 to 14½	14½ to 15	14½ to 15	15 to 15½	16 to 16½	....	....
11 17½ to 11 32½	12 30	11 95 to 12 07½	12 27½ to 12 32½	12 50 to 12 70	....	10 65 to 11 75
21 to 26	21 to 35	21 to 24	25 to 30	25 to 31	30 to 38	30 to 37
16 to 22	15 to 21	16 to 21	18 to 24	20 to 25	24 to 33	24 to 32
12 to 12½	9¼ to 10	10 to 11	10 to 11	10 to 11	12½ to 13½	10½ to 11
3 to 10½	2 to 7½	2 to 8½	2 to 11	2 to 9	2 to 11	2 to 10½
7¼ to 8½	7½ to 8⅛	7½ to 8⅞	7 to 8¼	7½ to 8½	7 to 8½	6½ to 7¾
37 to 38	37 to 40	37 to 40	35 to 38	35 to 38	35 to 38	35 to 38
37 to 39	37 to 40	37 to 40	30 to 37	30 to 37	30 to 37	30 to 37
18 to 21	25 to 28	25 to 28	25 to 28	25 to 28	25 to 28	25 to 27
3 50 to 4 75	4 00 to 4 50	3 50 to 3 75	3 60 to 3 90	3 25 to 3 60	3 25 to 3 60	2 50 to 3 10
5 00 to 5 40	5 00 to 5 40	4 00 to 4 35	4 10 to 4 40	3 90 to 4 15	3 75 to 4 00	3 65 to 4 00
5 75 to 6 00	5 75 to 6 00	4 75 to 5 00	4 75 to 5 00	4 40 to 4 50	3 75 to 4 60	4 30 to 4 40
6 40 to 7 25	6 35 to 7 00	5 75 to 6 75	5 50 to 6 25	5 00 to 5 50	4 85 to 5 40	4 75 to 5 25
1 30 to 1 32	1 29 to 1 30	1 00 to 1 01	1 00 to 1 00¾	97 to 98	95 to 96	1 00 to 1 00¼
....	....	1 03 to 1 03½	1 00 to 1 02	99 to 1 02	97 to 99	1 02
76⅝ to 76¾	75¾ to 76	75¾	76¼ to 76½	64¾	68	68
84¾ to 85	87	86½ to 88	78½	64	Nominal	Nominal ....
77	76		76 to 76½	64½	68 to 69	70
55 to 56	57 to 59	53 to 67	39½ to 45	31 to 39	35½ to 40½	39 to 42½
75½ to 78⅝	68½ to 70	67 to 71	75 to 78	62¾ to 63	62 to 62½	59 to 62½
87 to 1 00	Nominal	50	55 to 85	70 to 83	65 to 70	65 to 75
18 00 to 19 00	17 00 to 18 00	19 50 to 20 50	16 00 to 16 50	14 00 to 14 50	13 00 to 13 50	12 00 to 13 00
14 00 to 17 50	14 00 to 16 50	15 00 to 18 00	13 00 to 15 50	10 00 to 13 00	10 00 to 12 50	9 00 to 11 50
19 50 to 20 25	22 25	21 50 to 21 75	23 00 to 23 25	23 00 to 23 25	22 25 to 23 50	17 50 to 18 00
14 to 15	14½ to 15	14¾ to 15¼	14¾ to 15¼	15¾ to 16½	15¼ to 15½	14¼ to 14¾
10⅜ to 11	10⅜ to 11	11¾ to 12¼	11¾ to 12¼	12½ to 12¾	11¼ to 11½	10 to 10¼
14 to 14½	14 to 14½	15 to 15½	15¼ to 15¾	16½ to 17	16¼ to 16½	13½ to 13¾
11 75	11 75	12 25	12 35	12 75 to 13 00	11 30 to 11 70	10 75 to 10 82
23 to 25	26 to 27	25 to 27	27 to 30	30 to 35	35 to 40	27 to 36
14 to 20	15 to 22	17 to 20	16 to 22	20 to 28	18 to 30	14 to 28
9 to 10	9 to 10	8½ to 9½	10 to 10½	11 to 12	12 to 12½	11½ to 12
8 to 8½	7½ to 9	7 to 8	7½ to 9	10 to 10½	8 to 11½	9 to 11
1 50 to 2 00	75 to 80	55 to 65	50 to 60	55 to 60	50 to 60	55 to 80
5¾ to 8¼	6 to 8¼	4 to 8¼	4½ to 8½	2 to 8¼	2 to 8¼	3¾ to 4¼
8½ to 9	8½ to 9	8½ to 9	7½ to 9	8½ to 10	8½ to 10	5¾ to 7
9⅛ to 10⅝	9½ to 11	9⅞ to 11⅜	10 to 11½	8⅝ to 10⅛	8 to 9¼	7¾ to 9¼
10⅝ to 10¾	11⅝ to 12½	12 to 12⅞	12⅛ to 13	10¾ to 11½	10 to 10½	9¾ to 10¼
12⅞ to 13⅝	13¼ to 14	13⅝ to 14⅞	13¾ to 14½	12¼ to 13	11¼ to 12	11 to 11¾
33 to 40	33 to 40	33 to 38	33 to 35	35 to 36	32 to 34	32 to 34
28 to 36	25 to 36	28 to 36	28 to 36	28 to 37	26 to 34	27 to 35
16 to 24	16 to 25	15 to 25	15 to 25	15 to 23	14 to 21	14 to 21
28 to 29	28 to 29	28 to 29	28 to 29	28 to 29	23 to 25	24 to 25
5 80 to 5 95	5 90 to 6 15	4 90 to 5 00	4 85 to 4 95	4 45 to 4 65	4 45 to 4 60	4 40 to 4 50
1 24 to 1 24½	1 32	96 to 97⅜	98¼ to 98½	90¼ to 91¾	93 to 93¼	94¼ to 94½

MARKET PRICES OF FARM

Product.	January.	February.	March.	April.	May.
SAINT LOUIS—Continued.					
Corn, No. 2 mixed......do..	$0 65½ to $0 65¾	$0 61¼ to $0 61⅞	$0 57¾ to $0 58	$0 69 to $0 70	$0 73½ to $0 74½
Rye....................do..	95 to 96	95	95	81 to 81½	81 to 82
Barley.................do..	....	 85	89½ to 91	85 to 97	90 to 93
Oats...................do..	45 to 47	46¾ to 47	43½ to 45	51½	54
Potatoes...............do..	1 05 to 1 25	1 12½ to 1 36	1 20 to 1 32½	1 00 to 1 27½	1 05 to 1 35
Hay:					
Timothy..............ton.	22 00 to 22 50	17 00 to 22 00	16 00 to 18 00	18 50 to 22 00	21 50 to 22 00
Prairie...............do..	9 00 to 12 50	10 00 to 12 75	9 50 to 11 50	....	14 75 to 15 00
Pork:					
Mess.................bbl.	17 00 to 17 50	19 00 to 19 25	17 40 to 17 50	17 50 to 17 60	18 40 to 19 40
Bacon..............cental.	..........9 90	.........10 00	9 90 to 10 00	10 70 to 10 90	8 00 to 11 50
Hams..................do..	11 25 to 13 50	12 00 to 13 50	10 40 to 10 50	12 50 to 14 50	12 75 to 14 00
Lard...................do..	11 00 to 11 75	11 00 to 11 35	10 57½ to 10 60	10 85 to 11 25	11 75 to 12 00
Beef:					
Extra mess...........bbl.	13 00	13 00	13 00	12 00 to 16 00	12 00 to 17 00
Family..........half bbl.	7 50	7 25	7 25	8 50	8 00 to 9 00
Butter:					
Creamery...............lb.	34 to 38	35 to 40	44 to 48	42 to 45	20 to 29
Dairy..................do.	30 to 38	18 to 35	20 to 42	25 to 40	18 to 24
Cheese:					
Cream..................lb.	13 to 14	12 to 14	12 to 14	11 to 13	12 to 13½
Lower grades..........do.	8 to 9	8½ to 10	8 to 10	6½ to 10	7½ to 10
Tobacco:					
Common to good lugs (burley)..........cental.	4 50 to 7 00	4 50 to 7 00	4 25 to 6 50	4 00 to 6 00	4 00 to 5 50
Common leaf (burley).do.	7 50 to 10 50	7 50 to 10 50	6 00 to 8 00	6 50 to 7 00	5 50 to 7 50
Medium to fine (burley) do.	12 00 to 20 00	12 00 to 20 00	9 00 to 17 00	8 00 to 17 00	8 00 to 17 00
Wool:					
Tub-washed.............lb.	30 to 38	30 to 38	31 to 37	31 to 38	37 to 37½
Low to medium combing, unwashed...........lb.	24 to 25	22 to 25	23½ to 25	23 to 25	21 to 24½
Peanuts................do.	3½ to 5	7 to 10	6 to 6½	6 to 6½	6 to 6½
Sugar, New Orleans, common to choice.......lb.	7½ to 8½	7¼ to 8½	7⅜ to 8½	7¾ to 8½	8¼ to 8⅜
Cotton:					
Ordinary to good ordinary..................lb.	9 to 10½	9 to 10½	9⅜ to 10⅜	9½ to 10¾	9¾ to 10¾
Low middling to good middling.............lb.	11 to 11⅝	11 to 11⅞	11⅜ to 11⅝	10⅜ to 12⅜	11⅞ to 12⅜
KANSAS CITY.					
Flour:					
Choice...............sack.	3 40	3 45	3 25	....	....
Fancy..................do..	3 60	3 70	3 50	....	....
Wheat, No. 2 red winter, bush....................	....	1 04 to 1 06	1 09 to 1 10	....	1 23¼ to 1 24
Corn No. 2 mixed.....bush.	....	58¾	57½ to 58	71½	71
Rye....................do..	....	92	....	72	75
Barley.................do..	....	....	....	....	....
Oats...................do..	....	45⅝	44½ to 45	50	53¾ to 54
Potatoes...............do..	1 00 to 1 15	1 10 to 1 27½	1 20 to 1 37	1 20 to 1 40	90 to 1 20
Hay...................ton.	5 00 to 9 00	6 00 to 9 50	6 00 to 9 00	7 00 to 10 50	7 00 to 14 00
Pork:					
Mess..................bbl.	18 00	18 00	19 00	....	....
Clear..................do..	20 00	20 00	21 00	....	....
Hams, sugar-cured.cental.	12 50	12 50	11 75	....	....
Bacon, sugar-cured...do..	12 50	12 50	12 00	....	....
Lard, in tierce..........lb.	11¾	11¾	11½	....	....
Butter:					
Creamery...............lb.	38 to 40	35 to 38	42 to 45	40 to 45	30 to 38
Dairy, Kansas.........do.	21 to 23	26 to 29	35 to 38	32 to 35	21 to 22
Cheese:					
Full cream, Eastern...lb.	14	14	14	14	14
Kansas.................do.	12 to 13	10 to 11	10 to 11	10	11
Sugar, New Orleans.....do.	6½ to 8	7½ to 8	....	....	....
Peanuts................do.	6	6	6	6	6
Wool:					
Unwashed..............lb.	14 to 23	14 to 22	14 to 23	14 to 23	14 to 23
Tub-washed............do.	38 to 40	38 to 40	38 to 40	38 to 40	38 to 40
Colorado and New Mexico.....................lb.	14 to 20	14 to 20	14 to 20	14 to 20	14 to 20
NEW ORLEANS.					
Flour:					
Superfine.............bbl.	4 50 to 4 75	5 00 to 5 25	Nominal.	Nominal.	Nominal.
Family.................do.	6 25 to 6 50	7 00 to 7 12½	6 25 to 6 50	6 37½ to 6 60	6 50 to 6 75
Minnesota patents....do.	8 00 to 8 50	7 50 to 8 50	8 00 to 8 50	7 62½ to 8 00	8 50 to 9 00
Wheat, No. 2 red Western, bushel....................	....	1 50	....	....	....

PRODUCTS FOR 1882—Continued.

June.	July.	August.	September.	October.	November.	December.
$0 70⅞ to $0 73	$0 76⅛ to $0 76¾	$0 77½ to $0 78½	$0 69½	$0 60½ to $0 61	$0 63 to $0 64	$0 51 to $0 51¼
72	....	59 to 63	$0 63½ to 65	55½	56½ to 57	55
92½	....	....	77½	67½	65 to 75	62 to 65
56	52 to 53	50 to 50½	33¼ to 33½	31½	31½	35¼ to 36
1 60 to 2 10	1 00 to 2 00	35 to 60	60 to 75	50 to 60	40 to 57	70 to 75
20 00 to 24 00	25 00 to 27 00	19 00 to 20 00	12 00	11 50 to 15 00	12 50 to 16 00	12 00 to 15 00
14 50	16 00	9 00 to 10 00	7 25 to 8 00	8 50 to 9 25	7 00 to 10 00	9 00 to 10 25
19 80	22 75 to 23 00	21 00	22 00 to 22 40	22 75	22 00	17 25
9 50 to 14 00	10 00 to 13 50	13 40 to 14 00	14 75 to 15 15	11 00 to 15 50	14 00 to 15 50	11 35 to 13 25
15 00 to 17 50	16 00 to 16 25	15 50 to 16 50	15 00 to 15 50	16 00 to 17 00	16 00 to 17 00	14 50 to 15 00
11 00 to 11 05	11 60 to 12 00	11 65 to 12 05	12 25 to 13 25	....	13 00 to 13 50	10 50 to 10 70
13 00 to 17 00	13 00 to 17 25	13 00 to 18 00	13 00 to 18 00	13 00 to 18 00	13 00 to 18 00	12 00 to 16 00
8 00 to 9 00	8 00 to 9 50	8 00 to 9 50	8 00 to 9 50	8 00 to 9 50	8 00 to 9 50	7 00 to 8 50
24 to 25	24 to 28	23 to 25	25 to 32	24 to 31	34 to 39	33 to 37
20 to 21	14 to 22	16 to 20	16 to 25	18 to 27	22 to 32	27 to 32
11 to 13	10½ to 11	10½ to 11	11 to 13	11½ to 13½	12½ to 13½	12 to 13½
7½ to 10	6½ to 7½	6½ to 7½	7½ to 9	8½ to 9½	9 to 10½	8 to 8½
4 75 to 5 75	4 75 to 5 75	4 60 to 5 60	5 00 to 6 00	....	5 00 to 7 00	....
6 00 to 8 00	6 00 to 8 00	7 00 to 7 25	7 00 to 8 00	....	6 00 to 9 00	....
8 50 to 15 20	8 50 to 20 00	8 50 to 20 00	8 50 to 20 00	....	10 00 to 20 00	....
30 to 37	30 to 37	30 to 37	28 to 38	28 to 37½	30 to 36	30 to 35
18 to 23	20½ to 21½	16 to 22½	17 to 22½	17 to 19	20 to 25	20 to 25
6 to 8½	6½ to 10	6½ to 10	6½ to 10	....	4½ to 6½	3½ to 5
8 to 8⅝	8 to 8⅝	....	9½	9½	7 to 7¼	6½ to 7
9½ to 10¼	9¾ to 11	10⅛ to 11⅜	10⅛ to 11⅞	8½ to 9¾	8½ to 9¼	7⅞ to 8⅞
11⅜ to 12⅛	12¼ to 12½	12⅝ to 12⅞	12⅛ to 12⅞	10½ to 11¼	9⅞ to 10⅜	9⅞ to 10
3 25	3 30	2 90	....	2 20 to 3 25	2 30 to 3 40	2 50 to 3 00
3 40	3 40	3 00	....	2 40	2 50 to 3 15	3 00 to 3 10
1 12 to 1 18	1 05 to 1 10	79¾ to 81	83⅜	79	77	84
73 to 74	68¾ to 69¼	60 to 66	68½	53	52	43¼
60	55	47½	54	47½	48	45¼
....	....	....	....	....	....	....
52½	50 to 53	34¼	34¾	29	29 to 31	32½
90 to 1 25	....	40 to 55	25 to 50	40 to 45	45 to 60	55 to 65
8 75 to 12 00	6 00 to 12 00	6 00 to 7 50	3 25 to 7 00	3 25 to 7 00	3 00 to 7 70	6 50 to 8 00
21 00	22 00	23 00	....	23 50	23 00	21 00
23 00	....	26 00	....	28 50	28 00	25 00
14 50	14 50	15 00	....	15 75	15 50	15 25
14 25	14 75	16 00	....	18 75	18 75	15 25
11⅝	12	13	....	12¾	....	11½
25 to 28	18 te 22	18 to 22	22 to 25	25 to 26	26	25 to 27
15 to 16	14 to 15	15 to 16	19 to 20	35 to 38	36 to 38	35 to 38
10½ to 13	11 to 11½	10 to 13	13 to 13½	13 to 14	13 to 14	14 to 15
12 to 13	8½ to 9½	6 to 8	6 to 8	6 to 8	6 to 9	10 to 12
....	....	....	....	....	....	....
3 to 4	3 to 4	3 to 4	3 to 4	3 to 4	3 to 4	3 to 4
14 to 20	17 to 22	16 to 21	17 to 21	16 to 21	16 to 21	16 to 21
38 to 40	30 to 32	30 to 32	30 to 32	30 to 32	30 to 32	30 to 32
14 to 16	....	12	14 to 18	14 to 18	14 to 18	14 to 18
Nominal.	Nominal.	Nominal.	Nominal.	Nominal.	Nominal.	Nominal.
6 25 to 6 50	6 25 to 6 50	5 00 fo 5 12½	4 80	4 62½	4 70 to 4 90	4 60 to 4 75
8 00 to 9 00	8 00 to 8 75	8 00 to 8 62½	7 25 to 7 50	6 25 to 7 00	6 25 to 7 00	6 12½ to 6 62½
90 to 95	95 to 1 15	1 08 to 1 09	1 05	1 03 to 1 04	1 02 to 1 03	1 04

MARKET PRICES OF FARM

Product.	January.	February.	March.	April.	May.
NEW ORLEANS—Contiued.					
Corn, mixed..........bush.	$0 76 to $0 77	$0 80	$0 67	$0 75	$0 85
Oats.....................do..	54 to 57	$0 56½ to 57½	$0 54 to 55	$0 64 to 65	$0 64 to 65
Potatoes.................bbl.	3 00 to 4 00	3 10 to 3 90	2 75 to 4 00	4 00 to 3 15	3 50
Hay:					
Prime...............ton.	21 00 to 23 00	23 00	....	27 00 to 28 00	23 00
Choice...............do.	25 00	25 50 to 26 50	....	29 00 to 30 00	24 00 to 25 00
Beef:					
Western.............bbl.	12 00 to 13 00	12 00 to 13 00	11 00 to 12 50	12 50 to 14 00	11 50 to 14 00
Fulton market...half bbl.	9 00	9 00	9 00	9 75	10 00 to 12 35
Pork:					
Mess...............bbl.	17 50 to 17 75	19 25 to 19 75	18 25 to 18 37½	17 50 to 18 00	19 25 to 19 50
Bacon...............lb.	8 to 10⅝	7¾ to 10¾	7¾ to 11¼	7⅞ to 10	11½ to 11⅝
Ham...............do.	11½ to 13	11½ to 13	12 to 12½	11 to 12½	13 to 13¾
Lard...................do.	11½ to 12½	11⅜ to 11¾	11¼ to 11½	11⅜ to 11½	11½ to 11⅝
Butter:					
Western creamery....lb.	33 to 46	33 to 44	35 to 55	33 to 46	24 to 32
Western dairy.........do.	17 to 30	13 to 30	13 to 30	22 to 30	25 to 28
Cheese:					
Choice factory.........lb.	12½ to 13	11½ to 12	12 to 12½	12	....
New York cream.....do.	16	16	16	15	16½
English dairy.........do.	17	....	....	....	....
Sugar:					
Fair to fully fair......lb.	6⅜ to 7	6½ to 7	6⅝ to 7⅛	6¾ to 7⅜	7½ to 8
Prime to strictly prime, pound..................	7⅛ to 7½	7¼ to 7⅜	7⅜ to 7⅝	7⅛ to 7⅝	8⅛ to 8¼
Clarified...............lb.	8 to 8¾	8⅛ to 9	8¼ to 8¾	8¼ to 8⅞	8¾ to 9½
Cotton:					
Low ordinary.........lb.	8⅛ to 8¼	8½ to 8¾	8⅝ to 8⅞	9⅜ to 9⅝	9⅝ to 9¾
Ordinary to good ordinary, pound..................	9¼ to 10⅝	9½ to 10¾	9⅝ to 10⅝	10⅞ to 11¼	10⅝ to 11⅜
Low middling to good middling............lb.	11⅛ to 11⅞	11¼ to 12⅛	11⅛ to 12⅛	11½ to 12½	11⅝ to 12½
Middling fair..........lb.	12 to 12⅛	12⅛ to 12⅜	12⅛ to 12¼	12⅝ to 12¾	12⅝ to 12¾
Tobacco:					
Low to good lugs......lb.	6 to 7⅞	6 to 7⅞	6 to 7⅞	5¾ to 7	5½ to 7¼
Low to medium leaf...do.	8 to 9½	8 to 9½	8 to 9½	7¼ to 8½	7 to 9
Good to fine leaf........do.	10 to 12½	10 to 12½	10 to 12½	9 to 11½	9 to 11
Wool:					
Burry.................lb.	9 to 12	9 to 12	11	10 to 13	9 to 12
Louisiana clear........do.	22 to 23	22 to 23	20 to 22	20 to 23	14 to 20
Clear Lake.............do.	25 to 26	25 to 26	25	25	20 to 23
Peanuts.................do.	6 to 8½	6 to 8½	6 to 10	7¾	6½ to 8
Rice:					
Common to good......lb.	4 to 6¼	4 to 6¼	4 to 6¼	5 to 6⅝	5½ to 7¼
Prime to choice.......do.	6⅜ to 6¾	6⅜ to 7	6½ to 6⅞	6¾ to 7¼	7⅜ to 7¾
SAN FRANCISCO.					
Flour:					
Superfine, No. 1......bbl.	3 75 to 4 00	3 50 to 4 00	4 50 to 4 75	3 75 to 4 00	3 75 to 4 00
Extras..................do..	5 00 to 5 50	4 70 to 5 00	4 75 to 5 00	4 75 to 5 25	4 75 to 5 75
Wheat:					
California..........cental.	1 50 to 1 70	1 50 to 1 67½	1 50 to 1 65	1 50 to 1 60	1 50 to 1 70
Oregon...............do..	1 40 to 1 65	1 40 to 1 65	1 40 to 1 65	1 40 to 1 60	1 40 to 1 65
Barley...................do..	1 50 to 1 65	1 50 to 1 80	1 80 to 1 90	1 75	1 55 to 1 90
Corn.....................do..	1 50	1 80	1 90 to 2 00	1 50	1 65
Oats.....................do..	1 75 to 1 80	1 75 to 2 00	1 75 to 1 90	1 65 to 1 75	1 85 to 2 00
Potatoes..............bush.	1 00 to 1 30	1 50 to 2 00	1 80 to 2 00	1 50 to 1 80	1 75 to 4 50
Hay......................ton.	9 00 to 14 00	10 00 to 16 00	11 00 to 17 00	10 00 to 15 00	10 00 to 15 00
Pork:					
Mess...................bbl.	18 00 to 20 00	18 00 to 20 00	18 00 to 20 00	18 00 to 20 00	20 00
Extra prime mess....do.	15 00 to 16 00	15 00 to 16 00	15 00 to 16 00	15 00 to 16 00	16 00
Bacon, domestic.......lb.	12½ to 13	12½ to 13	12½ to 13	12½ to 13	12½ to 13
Hams...................do.	13 to 15	13 to 15	13 to 15	13 to 15	13 to 15½
Lard, in tierce.........do.	13 to 13½	13 to 13½	15 to 16	16 to 16½	16 to 16½
Beef:					
Mess...................bbl.	10 00 to 10 50	10 00 to 10 50	10 00 to 10 50	16 00 to 16 50	10 00 to 10 50
Family mess....half bbl.	7 50 to 8 00	7 50 to 8 00	7 50 to 8 00	10 00 to 10 50	8 00 to 8 50
Butter:					
Overland and Eastern.lb.	20 to 25	20 to 25	20 to 25	20 to 22	20 to 22
Oregon.................do.	20 to 25	20 to 25	20 to 25	20 to 22	20 to 22
California..............do.	25 to 40	25 to 35	25 to 35	25 to 27	25 to 28
Cheese...................do.	15 to 17	15 to 17	15 to 17	15 to 17	15 to 17
Wool:					
Los Angeles and Southern..................lb	10 to 12	10 to 12	10 to 12	10 to 12	18 to 20
San Luis Obispo and Coast.................lb.	12½ to 13	12½ to 13	12½ to 13	12½ to 13	20 to 22
San Joaquin Valley...do.	12½ to 13	12½ to 13	10 to 13	10 to 13	18 to 23

PRODUCTS FOR 1882—Continued.

June.	July.	August.	September.	October.	November.	December.
$0 86	$0 85	....	$0 78 to $0 82	$0 75	$0 75	....
$0 67 to 70	$0 49 to 55	$0 52 to $0 55	50 to 53	$0 45 to 55	$0 47 to 65	$0 47 to $0 48
4 00 to 4 75	4 50 to 4 75	2 50 to 2 75	2 50 to 2 60	2 25 to 2 50	2 00	3 00
26 00 to 27 00	25 00	24 00	18 00 to 19 00	18 50 to 19 00	17 00 to 17 25	18 00 to 19 00
29 00	27 00 to 28 00	26 00 to 28 00	20 00	19 00 to 20 00	18 00 to 18 50	20 00
11 50 to 14 00	16 00 to 20 00	16 00 to 18 00	16 00 to 17 50	14 00 to 15 00	14 00 to 15 00	12 00 to 15 00
10 00 to 12 00	12 00 to 12 50	12 00 to 12 50	13 00	13 00	12 75	12 75
20 50 to 21 00	23 00	21 75	22 00	22 75 to 23 00	23 25	18 25 to 18 50
9½ to 9⅝	10⅜ to 14½	10¾ to 14¼	10½ to 14¾	10¾ to 16¼	11 to 16¼	7⅞ to 10¼
14½ to 15¼	14 to 15½	14½ to 15½	15 to 15½	16¼ to 17½	15 to 16	15½ to 16
11¾ to 11⅞	12¼ to 12⅜	12¾ to 13¼	13	13⅛ to 13½	12½ to 12¾	11¾ to 11⅞
22 to 26	22 to 29	24 to 28	23 to 29	28 to 33	40 to 45	36 to 42
18 to 22	19 to 22	14 to 24	15 to 24	16 to 24	16 to 30	20 to 28
....	10 to 12	12 to 12½	11½ to 12	11½ to 12	10½ to 12	11 to 12½
14 to 15	14 to 15	15 to 16	15 to 16	15 to 16	15	15
....	....	....	....	....	....	....
7½ to 8	7¾ to 8½	7½ to 8⅜	7¼ to 8	8½	5¾ to 6⅝	5½ to 5⅞
8½	8¼	8½	8½	8¾	....	6 to 6¼
8⅝ to 9¼	8⅝ to 9⅛	8¾ to 9	8⅞ to 9⅛	8⅝ to 9	7¼ to 8 7/16	7 to 7⅞
9⅝ to 9⅞	9½ to 9¾	9½ to 9⅝	9 to 9⅜	8 to 8⅛	....	....
10⅝ to 11¼	10⅝ to 11¾	10⅝ to 11¾	10 to 11	9⅛ to 10½	8¼ to 9½	7⅞ to 9⅛
11½ to 12¼	12 to 13	12¼ to 13¼	12 to 13⅛	10¾ to 11⅝	10 to 10¾	9½ to 10¼
12½ to 12¾	13 to 13¼	13¼ to 13½	13 to 13¼	11⅝ to 11⅞	10¾ to 10⅞	10⅜ to 10½
5⅛ to 7¼	5½ to 7¼	5½ to 7¼	5⅜ to 7⅛	5¾ to 7	5¾ to 7	6½ to 7
7½ to 9	7½ to 9	7¼ to 9	7½ to 9	7 to 8¾	7 to 8¾	7 to 8¾
10	10	10	9⅜ to 10	9 to 10½	9 to 10½	9 to 10½
10 to 12	10 to 15	11 to 15	12 to 15	12 to 15	11 to 16	11 to 16
23 to 24	24 to 25	23 to 25	22 to 24	22 to 23	22	22
25 to 26	22 to 23	26 to 27	26 to 27	24 to 25	24 to 25	24 to 25
7¼ to 12	8 to 11	7½ to 9½	7 to 9	6 to 11½	6½	6 to 7½
4¾ to 7¼	5 to 6¾	5 to 6¾	5 to 6	3¾ to 5½	3¾ to 5½	4¼ to 5½
7¼ to 7¾	7 to 7½	7 to 7½	6 to 6¾	5¾ to 6¼	5⅝ to 6⅞	5¾ to 6¼
4 00 to 4 25	4 00 to 4 35	4 00 to 4 25	4 00 to 4 25	4 25 to 4 50	4 00 to 4 50	4 00 to 4 50
4 75 to 5 50	5 00 to 5 25	5 00 to 5 50	5 00 to 5 50	5 25 to 5 50	5 25 to 5 50	5 25 to 5 50
1 50 to 1 72½	1 60 to 1 70	1 60 to 1 75	1 60 to 1 65	1 60 to 1 70	1 60 to 1 70	1 60 to 1 72½
1 50 to 1 60	1 50 to 1 65	1 50 to 1 70	1 50 to 1 60	1 50 to 1 65	1 50 to 1 65	1 50 to 1 65
1 85 to 1 90	1 95 to 2 00	1 40 to 2 10	1 35 to 2 10	1 35 to 1 37½	1 35 to 1 38	1 50 to 1 55
1 70 to 1 75	1 80 to 1 85	1 50 to 1 65	1 70 to 1 80	1 70 to 1 80	1 80 to 2 00	1 60 to 2 20
1 95 to 2 05	1 60 to 1 65	1 70 to 1 80	1 60 to 1 75	1 50 to 1 65	1 90 to 2 00	1 75 to 2 00
1 25 to 2 00	40 to 1 00	50 to 90	70 to 1 00	75 to 1 00	65 to 1 15	50 to 1 15
10 00 to 15 00	10 00 to 15 00	10 00 to 15 00	12 00 to 16 00	12 00 to 16 50	13 00 to 17 50	12 00 to 17 50
20 00	20 00	25 00 to 26 00	25 00 to 26 00	25 00 to 25 40	25 00 to 25 50	25 00 to 25 50
16 00	16 00	20 00 to 21 00	20 00 to 21 00	20 00 to 21 00	20 00 to 21 00	20 00 to 21 00
13 to 14	15 to 16	16 to 18	16 to 18	16 to 18	16 to 18	16 to 17
13 to 15½	14 to 16	15 to 17	15 to 17	16 to 19	16 to 19	16 to 20
16 to 16½	16 to 16½	16 to 17	16 to 17	16 to 17	16 to 17	14½ to 15
10 00 to 10 50	10 00 to 10 50	13 00 to 14 00	13 00 to 14 00	13 00 to 14 00	14 00 to 15 00	14 00 to 15 00
8 00 to 8 50	8 00 to 8 50	....	....	....	....	....
20 to 22	20 to 22	20 to 22	20 to 25	20 to 25	20 to 22	20 to 22
20 to 22	20 to 22	20 to 22	20 to 25	20 to 25	20 to 25	20 to 25
25 to 30	25 to 30	25 to 30	25 to 35	30 to 45	30 to 42	30 to 35
15 to 17	15 to 17	15 to 17	12½ to 17	12½ to 17	12½ to 17	12½ to 17
18 to 22	15 to 20	15 to 20	15 to 20	15 to 19	15 to 19	15 to 17
20 to 22	....	....	....	....	....	....
18 to 23	15 to 21	15 to 21	15 to 20	15 to 20	15 to 20	14 to 18

MARKET PRICES OF FARM

Product.	January.	February.	March.	April.	May.
SAN FRANCISCO—Cont'd.					
Wool—Continued.					
Sacramento and Northern .... lb.	$0 15 to $0 18	$0 15 to $0 18	$0 15 to $0 18	$0 15 to $0 18	....
Humboldt and Mendocino .... lb.	16 to 20	16 to 20	15 to 22	15 to 22	....
Oregon Valley .... do.	....	....	....	25 to 28	....
Eastern Oregon .... do.	....	....	....	20 to 25	....

LIVE-STOCK

NEW YORK.					
Cattle:					
Best beeves .... cental.	$9 25 to $12 25	$9 50 to $12 50	$10 00 to $12 50	$12 50 to $13 25	$13 75 to $14 50
Common to good .... do.	8 25 to 9 00	8 50 to 9 25	9 75 to 11 00	10 25 to 11 75	12 00 to 13 00
Milch cows .... head.	40 00 to 60 00	40 00 to 65 00	30 00 to 60 00	30 00 to 60 00	35 00 to 65 00
Veal calves .... cental.	6 50 to 9 50	6 50 to 9 50	6 00 to 9 50	7 00 to 9 75	5 50 to 8 00
Sheep .... do.	4 45 to 6 50	3 85 to 6 00	4 75 to 6 75	5 25 to 7 75	7 50 to 8 00
Swine .... do.	5 50 to 6 50	5 00 to 6 87	6 50 to 7 00	6 75 to 7 00	6 50 to 7 50
BOSTON.					
Cattle:					
Fair to good country cattle .... cental.	....	....	....	6 75 to 8 00	....
Premium bullocks .... do.	....	....	....	9 75 to 10 00	....
Milch cows .... head.	....	....	....	30 00 to 60 00	....
Veal calves .... cental.	....	....	....	4 50 to 6 50	....
Sheep .... do.	....	....	....	3 00 to 6 50	....
Swine .... do.	....	....	....	7 00 to 7 75	....
CHICAGO.					
Cattle:					
Extra beeves .... cental.	6 50 to 6 85	6 30 to 6 50	6 60 to 6 75	6 70 to 6 85	7 60 to 7 85
Choice beeves .... do.	5 85 to 6 35	5 85 to 6 10	5 90 to 6 35	6 00 to 6 40	7 30 to 7 50
Good beeves .... do.	5 50 to 5 75	5 25 to 5 50	5 50 to 5 75	6 00 to 6 15	6 90 to 7 15
Medium .... do.	4 50 to 5 15	4 50 to 5 00	5 25 to 5 40	5 75 to 6 20	6 50 to 6 75
Veals .... do.	3 50 to 7 50	3 50 to 7 50	3 50 to 7 50	3 75 to 5 50	4 50 to 7 75
Sheep .... do.	2 75 to 5 50	3 00 to 5 75	4 00 to 6 00	4 25 to 6 25	5 75 to 6 12½
Swine .... do.	6 00 to 6 75	6 45 to 6 90	6 15 to 7 30	6 20 to 7 35	6 85 to 7 75
SAINT LOUIS.					
Cattle:					
Export steers .... cental.	6 00 to 6 40	6 00 to 6 25	6 00 to 6 25	6 85 to 7 35	7 60 to 8 00
Fair to heavy steers .... do.	5 00 to 6 00	5 00 to 5 90	5 00 to 5 90	5 75 to 6 75	6 50 to 7 50
Medium to choice corn-fed Texas steers. cental.	3 25 to 5 25	3 25 to 4 50	3 25 to 5 40	3 75 to 5 60	4 50 to 6 25
Milch cows with calves ...	20 00 to 50 00	20 00 to 50 00	20 00 to 40 00	20 00 to 60 00	20 00 to 60 00
Sheep:					
Fair to good feeding wethers .... cental.	2 85 to 3 25	2 85 to 3 25	2 85 to 3 25	....	....
Good to choice mutton, cental	3 85 to 4 50	3 50 to 4 50	4 25 to 5 50	4 50 to 5 75	5 50 to 6 25
Stock .... cental.	2 00 to 3 00	2 00 to 3 00	2 00 to 3 00	2 50 to 3 50	2 75 to 4 00
Lambs .... head.	1 50 to 3 00	1 50 to 3 00	2 00 to 3 00	2 00 to 3 50	2 50 to 4 50
Swine, common to good packing .... cental.	6 50 to 6 75	6 40 to 6 70	6 20 to 6 50	6 00 to 6 40	6 85 to 7 35
Horses:					
Common farm stock. head.	50 00 to 75 00	70 00 to 85 00	65 00 to 80 00	60 00 to 100 00	65 00 to 125 00
Streeters .... do.	85 00 to 120 00	90 00 to 115 00	85 00 to 110 00	85 00 to 95 00	90 00 to 130 00
Heavy draft .... do.	75 00 to 200 00	65 00 to 200 00	135 00 to 200 00	135 00 to 200 00	140 00 to 225 00
Drivers .... do.	90 00 to 225 00	115 00 to 175 00	110 00 to 200 00	110 00 to 200 00	120 00 to 225 00
Mules:					
14 hands .... head.	80 00 to 85 00	80 00 to 85 00	70 00 to 80 00	75 00 to 80 00	....
14½ hands .... do.	100 00 to 105 00	100 00 to 110 00	95 00 to 110 00	105 00 to 115 00	115 00 to 125 00
15 to 15½ hands .... do.	115 00 to 145 00	115 00 to 150 00	115 00 to 155 00	120 00 to 150 00	125 00 to 160 00
16 to 16½ hands .... do.	110 00 to 220 00	130 00 to 220 00	125 00 to 220 00	120 00 to 220 00	120 00 to 200 00
KANSAS CITY.					
Cattle:					
Native cows .... cental.	2 25 to 3 10	3 25 to 4 80	3 00 to 4 50	3 65 to 4 25	4 00 to 4 50
Native steers .... do.	3 00 to 4 65	4 25 to 4 60	4 18 to 5 00	4 50 to 6 10	5 85 to 6 30
Native shippers .... do.	4 95 to 5 20	5 00 to 5 75	5 05 to 5 80	5 50 to 6 85	6 30 to 6 45
Swine .... do.	5 50 to 6 25	5 40 to 6 75	5 00 to 6 65	5 70 to 6 65	5 75 to 7 25
Sheep .... do.	....	....	....	4 35 to 4 40	....

PRODUCTS FOR 1882—Continued.

June.	July.	August.	September.	October.	November.	December.
$0 20 to $0 28½	....	$0 25 to $0 26	$0 23 to $0 25	$0 23 to $0 25	$0 23 to $0 25	$0 20 to $0 22
30	$26 to $27½	25 to 26	25 to 27	24 to 26	24 to 26	22 to 24
30	23 to 27	23 to 27	23 to 27	23 to 27	23 to 27	21 to 27
30	20 to 25	20 to 26½	18to 24	20 to 25	20 to 25	18 to 23

MARKETS.

$14 25 to $15 00	$14 50 to $15 50	$14 00 to $15 00	$12 25 to $13 75	$11 25 to $12 50	$10 25 to $12 25	$10 50 to $11 50
11 50 to 13 50	10 50 to 13 50	9 25 to 12 75	9 00 to 11 75	8 00 to 9 50	8 25 to 10 25	8 00 to 9 75
45 00 to *65 00	35 00 to 60 00	40 00 to 60 00	40 00 to 65 00	35 00 to 70 00	35 00 to 70 00	35 00 to 68 00
5 50 to 8 50	6 50 to 9 00	5 50 to 8 00	7 00 to 9 00	8 00 to 10 00	7 50 to 10 00	5 50 to 9 00
6 00 to 6 65	4 00 to 5 25	4 00 to 5 50	3 85 to 5 50	3 50 to 5 75	3 75 to 5 75	4 00 to 6 00
7 00 to 7 50	7 12 to 8 62	7 50 to 8 75	8 65 to 9 12	8 00 to 8 88	7 25 to 8 00	6 40 to 6 50
....	9 00 to 11 00	....	7 75 to 9 75	....	6 50 to 9 25	6 50 to 9 00
11 50 to 11 75	11 00 to 11 50	....	10 00 to 10 50	....	10 00 to 10 50	....
28 00 to 75 00	30 00 to 50 00	....	25 00 to 45 00	....	65 00 to 75 00	50 00 to 75 00
4 50 to 6 25	5 75 to 6 75	....	7 00 to 7 50	....	3 00 to 7 50	6 00 to 7 50
5 00 to 8 25	3 00 to 6 50	....	5 00 to 6 00	....	....	2 75 to 5 00
7 75 to 8 50	8 50 to 9 00	....	8 00 to 9 00	....	7 50 to 8 25	7 25 to 7 75
8 75 to 9 00	8 00 to 8 25	7 50 to 7 75	7 60 to 7 75	7 25 to 7 50	....	....
8 40 to 8 60	7 65 to 7 85	6 90 to 7 15	7 00 to 7 25	6 75 to 7 00	6 00 to 6 50	5 85 to 6 25
7 75 to 8 25	7 00 to 7 40	6 00 to 6 65	6 00 to 6 75	5 75 to 6 25	5 25 to 5 75	5 00 to 5 50
7 00 to 7 50	5 75 to 6 75	4 50 to 5 75	4 75 to 5 75	4 25 to 5 35	4 50 to 5 00	4 25 to 4 75
5 00 to 8 75	4 00 to 7 75	3 75 to 7 50	4 00 to 7 75	4 50 to 7 50	4 50 to 7 50	4 50 to 7 50
4 00 to 5 10	3 00 to 5 00	3 00 to 4 50	2 80 to 4 50	2 75 to 4 75	2 85 to 4 60	2 50 to 4 75
7 20 to 8 50	7 90 to 8 50	7 50 to 8 20	7 00 to 9 20	7 60 to 9 15	6 60 to 7 40	5 90 to 6 95
8 40 to 8 75	7 70 to 7 90	....	....	....	....	....
6 75 to 8 25	7 00 to 7 50	6 75 to 7 40	6 00 to 7 25	4 25 to 6 40	4 25 to 5 50	....
....	....	....	....	....	....	....
20 00 to 50 00	15 00 to 45 00	15 00 to 45 00	16 00 to 45 00	16 00 to 45 00	18 00 to 50 00	....
....	....	....	....	....	....	....
4 00 to 4 50	3 60 to 4 15	3 75 to 4 25	3 60 to 3 85	3 75 to 4 25	3 60 to 3 80	3 60 to 4 10
1 75 to 2 50	1 75 to 2 50	2 50 to 3 60	2 25 to 2 75	....	2 25 to 2 75	2 25 to 3 00
1 25 to 2 50	1 25 to 3 00	2 00 to 3 50	1 00 to 2 50	2 00 to 2 50	2 00 to 2 50	2 00 to 2 60
7 90 to 8 25	7 80 to 8 30	8 25 to 8 65	....	7 50 to 8 00	6 40 to 7 10	6 00 to 6 25
....	65 00 to 120 00	....	....	....	....	....
....	115 00 to 130 00	115 00 to 130 00	....	....	....	....
....	145 00 to 220 00	150 00 to 225 00	....	....	....	....
....	150 00 to 200 00	175 00 to 250 00	....	....	....	....
....	....	90 00 to 100 00	....	....	....	....
....	115 00 to 220 00	110 00 to 125 00	....	....	....	....
....	130 00 to 175 00	125 00 to 175 00	....	....	....	....
....	185 00 to 225 00	180 00 to 225 00	....	....	....	....
3 00 to 5 00	3 00 to 3 37½	2 80 to 3 05	2 90 to 4 40	2 50 to 3 30	2 50 to 3 25	2 50 to 4 30
4 00 to 4 65	....	....	3 45 to 4 10	2 65 to 2 70	2 65 to 2 70	2 65 to 3 25
....	....	3 50 to 4 10	4 80 to 5 00	....	....	3 25 to 4 00
6 00 to 8 05	6 90 to 7 80	6 90 to 7 85	7 00 to 8 80	6 35 to 7 75	6 05 to 7 00	5 75 to 6 30
4 00	....	2 00 to 3 50	....	....	....	....

* With calf.

LIVE-STOCK

Product.	January.	February.	March.	April.	May.
PHILADELPHIA.					
Cattle:					
Common to choice beeves, cental	....	$4 00 to $7 25	$4 25 to $7 37½	$5 25 to $7 75	$6 00 to $8 75
Milch cows .... head.	....	30 00 to 60 00	30 00 to 60 00	30 00 to 60 00	30 00 to 60 00
Sheep .... cental.	....	3 50 to 6 12½	3 00 to 6 75	5 00 to 7 25	5 00 to 8 50
Swine .... do..	....	8 25 to 10 25	8 25 to 10 50	8 50 to 10 25	10 00 to 11 00
NEW ORLEANS.					
Cattle:					
Texan, corn-fed, gross, cental	$3 00 to $5 50	3 00 to 5 50	2 50 to 6 00	2 50 to 6 00	3 00 to 5 50
Grass-fed .... head.	17 00 to 25 00	12 00 to 23 00	16 00 to 25 00	17 00 to 28 00	15 00 to 26 00
Milch cows .... do..	25 00 to 80 00	25 00 to 80 00	25 00 to 80 00	25 00 to 80 00	25 00 to 80 00
Calves .... do..	5 00 to 9 00	5 00 to 9 00	6 00 to 10 00	6 00 to 10 00	6 00 to 10 00
Sheep .... do..	1 50 to 3 50	1 50 to 3 50	1 50 to 3 50	1 50 to 4 00	1 50 to 4 00
Swine .... cental.	5 00 to 7 50	4 50 to 7 50	5 00 to 8 00	3 50 to 8 00	5 00 to 8 50
Horses:					
Common .... head.	70 00 to 110 00	70 00 to 110 00	70 00 to 110 00	70 00 to 110 00	70 00 to 110 00
Good work .... do..	110 00 to 150 00	110 00 to 150 00	110 00 to 150 00	90 00 to 125 00	90 00 to 125 00
Saddle and harness .. do..	150 00 to 200 00	150 00 to 200 00	150 00 to 200 00	150 00 to 200 00	150 00 to 250 00
Mules:					
Good medium .... head.	150 00 to 175 00	150 00 to 175 00	150 00 to 175 00	140 00 to 165 00	140 00 to 165 00
Rice .... do..	125 00 to 150 00	125 00 to 150 00	125 00 to 150 00	125 00 to 140 00	125 00 to 140 00
First class .... do..	175 00 to 225 00	175 00 to 225 00	175 00 to 225 00	165 00 to 180 00	165 00 to 180 00
Extra heavy .... do..	225 00 to 250 00	225 00 to 250 00	225 00 to 250 00	190 00 to 200 00	190 00 to 200 00
BALTIMORE.					
Cattle:					
Best beeves .... cental.	6 00 to 6 50	6 00 to 6 25	6 37 to 6 75	7 00 to 7 25	7 25 to 7 75
First quality .... do..	5 00 to 5 75	5 25 to 5 87	5 50 to 6 00	6 50 to 6 75	6 75 to 6 87
Medium .... do..	4 00 to 5 50	4 25 to 5 50	4 50 to 5 50	4 50 to 6 00	4 37 to 6 00
Milch cows .... head.	30 00 to 45 00	30 00 to 45 00	30 00 to 45 00	....	40 00 to 65 00
Swine .... cental (net*).	8 25 to 9 50	8 25 to 9 75	8 50 to 9 75	8 50 to 9 75	9 00 to 10 25
Sheep .... cental.	4 25 to 5 75	4 25 to 6 00	4 50 to 6 00	3 00 to 7 00	3 25 to 6 50
CINCINNATI.					
Cattle:					
Choice to extra shipping steers (gross) ... cental.	5 50 to 6 25	5 75 to 6 35	5 75 to 6 25	6 40 to 6 60	6 75 to 7 25
Fair to good shipping steers .... cental.	4 50 to 5 25	4 75 to 5 50	4 75 to 5 50	5 60 to 6 25	6 00 to 6 50
Good to choice, butcher's steers .... cental.	4 25 to 4 75	4 75 to 5 25	4 75 to 5 50	5 40 to 6 15	6 00 to 6 75
Fair to medium, butcher's grades .... cental.	3 50 to 4 00	3 50 to 4 50	3 50 to 4 50	4 10 to 5 15	5 00 to 5 75
Good to extra, fat cows and heifers ...... cental.	3 50 to 4 75	3 75 to 5 00	4 00 to 5 40	4 75 to 5 85	5 50 to 6 50
Sheep .... do..	3 00 to 5 25	3 25 to 5 50	3 50 to 5 75	3 50 to 6 25	4 00 to 6 25
Swine .... do..	5 00 to 6 60	5 50 to 7 45	5 50 to 7 50	5 50 to 7 50	3 00 to 7 25

MARKET PRICES OF FARM

Product.	January.	February.	March.	April.	May.
NEW YORK.					
Flour:					
Superfine .... bbl.	$2 60 to $3 65	$2 90 to $3 70	$3 30 to $3 90	$3 05 to $3 35	$3 25 to $4 20
Spring wheat extras, (good to choice) .... bbl.	3 90 to 4 00	4 10 to 4 20	4 20 to 4 25	4 10 to 4 15	4 35 to 4 40
Winter wheat extras .. do.	3 75 to 4 30	4 00 to 5 00	4 20 to 5 10	4 15 to 5 00	4 35 to 5 25
Patents .... do.	5 40 to 7 00	5 80 to 7 70	6 00 to 7 85	5 50 to 7 50	5 80 to 7 60
Wheat:					
No. 2 white .... bush.	98 to 99	1 05 to 1 06	1 08 to 1 09	1 02	1 07 to 1 08¼
No. 2 red winter ...... do.	1 09¾ to 1 10⅞	1 17½ to 1 17¾	1 22½ to 1 23½	1 21 to 1 21½	1 23 to 1 23
Corn:					
No. 2 mixed .... bush.	65½ to 67	68 to 70	72 to 74	65¾ to 66¼	67¼ to 68
Ungraded mixed ...... do.	55 to 64	64 to 69	69 to 75	50 to 66	40 to 65
Barley (State) .... do.	....	97 to 1 17	....	....	....
Oats .... do.	42 to 52	45 to 53	52 to 53¼	48 to 57½	48 to 56½
Rye .... do.	60 to 71	73½ to 75	75 to 80	76 to 76½	75½ to 80
Potatoes .... bbl.	....	2 75 to 3 00	2 00 to 4 75	2 00 to 3 25	2 25 to 2 75
Hay:					
First quality .... ton.	16 50 to 17 50	16 00 to 18 00	17 00 to 18 00	17 00	17 00 to 18 00
Second quality .... do.	15 00 to 16 00	15 00 to 16 00	15 00 to 15 50	15 00	15 00 to 16 00
Beef:					
Plain mess .... bbl.	11 00 to 11 75	11 00 to 12 00	11 50 to 12 50	11 50 to 12 50	11 50 to 12 50
Extra mess .... do.	12 00 to 13 00	12 25 to 13 00	12 50 to 13 50	12 50 to 13 50	12 75 to 13 50
Hams .... do.	16 00 to 17 50	18 00 to 19 00	....	21 50 to 22 00	22 00 to 22 50

*A deduction of 20 per cent. from live weight.

MARKETS—Continued.

June.	July.	August.	September.	October.	November.	December.
$8 25 to $10 00	$5 00 to $9 25	$4 00 to $8 00	$4 00 to $7 50	$4 00 to $7 25	$4 25 to $7 25	$3 25 to $6 75
30 00 to 100 00	30 00 to 100 00	30 00 to 80 00	30 00 to 75 00	30 00 to 100 00	40 00 to 100 00	40 00 to 100 00
3 00 to 6 50	2 50 to 5 25	3 00 to 5 62½	2 75 to 5 37½	3 00 to 5 62½	2 50 to 5 50	3 00 to 5 75
10 25 to 12 00	10 25 to 12 00	11 50 to 12 50	11 75 to 12 50	11 00 to 12 75	10 50 to 12 00	8 25 to 10 25
5 00	4 00 to 5 50	....	....	....	....	....
15 00 to 26 00	15 00 to 26 00	....	....	....	....	....
25 00 to 80 00	25 00 to 80 00	....	....	....	....	....
6 00 to 10 00	6 00 to 10 00	....	....	....	....	....
1 50 to 4 00	1 50 to 4 00	....	....	....	....	....
5 00 to 9 00	5 00 to 9 00	....	....	....	....	....
70 00 to 110 00	70 00 to 110 00	70 00 to 110 00	....	....	....	....
90 00 to 125 00	90 00 to 125 00	90 00 to 125 00	....	....	....	....
150 00 to 250 00	150 00 to 250 00	150 00 to 250 00	....	....	....	....
140 00 to 165 00	140 00 to 165 00	140 00 to 165 00	....	....	....	....
125 00 to 140 00	125 00 to 140 00	125 00 to 140 00	....	....	....	....
165 00 to 180 00	165 00 to 180 00	165 00 to 180 00	....	....	....	....
190 00 to 200 00	190 00 to 200 00	190 00 to 200 00	....	....	....	....
8 00 to 9 00	7 50 to 8 50	7 10 to 8 00	6 50 to 7 00	5 50 to 6 00	5 75 to 6 12	5 50 to 6 00
7 62 to 8 00	6 25 to 7 00	5 75 to 6 75	5 75 to 6 50	4 75 to 5 50	4 87 to 5 50	4 62 to 5 50
6 25 to 7 50	4 75 to 6 00	4 25 to 5 75	4 75 to 5 75	3 75 to 4 75	3 87 to 4 87	3 50 to 4 62
35 00 to 45 00	25 00 to 40 00	30 00 to 45 00	....	....	....	....
10 00 to 11 50	10 00 to 11 25	10 75 to 11 75	10 00 to 12 00	9 75 to 11 75	9 00 to 10 00	9 50 to 10 00
3 00 to 5 75	2 75 to 5 00	3 00 to 5 25	3 00 to 5 75	3 25 to 5 50	3 00 to 5 00	3 00 to 5 00
7 00 to 7 50	6 75 to 7 50	6 25 to 7 00	6 25 to 7 00	6 00 to 6 50	6 00 to 6 50	5 25 to 6 15
6 50 to 6 75	6 00 to 6 50	5 25 to 6 00	5 00 to 6 00	4 50 to 5 25	4 50 to 5 25	4 50 to 5 00
6 25 to 6 75	5 75 to 6 25	4 75 to 5 50	4 50 to 5 00	4 25 to 4 75	4 25 to 4 75	4 00 to 4 50
4 75 to 5 75	4 00 to 5 25	3 50 to 4 50	3 25 to 4 25	3 00 to 4 00	3 00 to 4 25	3 00 to 3 75
5 50 to 6 50	5 00 to 6 25	4 25 to 5 25	4 00 to 4 75	3 75 to 4 50	3 75 to 4 50	3 75 to 4 50
3 25 to 5 50	3 00 to 5 25	2 75 to 4 60	2 25 to 4 50	2 25 to 4 75	2 25 to 4 50	2 25 to 4 25
6 00 to 8 30	6 50 to 8 50	6 50 to 8 80	6 50 to 8 90	6 25 to 8 85	5 25 to 7 35	5 25 to 6 25

PRODUCTS FOR 1883.

$3 40 to $4 20	$2 75 to $3 90	$3 65 to $3 80	$3 20 to $3 90	$2 80 to $3 75	$2 80 to $3 45	$3 00 to $3 25
4 35 to 4 45	4 25 to 4 30	4 25 to 4 35	4 25 to 4 30	4 00 to 4 10	3 75 to 4 00	3 75 to 4 00
4 50 to 5 40	4 20 to 5 20	4 25 to 5 30	4 50 to 5 25	4 50 to 5 15	4 50 to 5 00	4 50 to 5 00
5 90 to 7 50	5 50 to 7 10	5 75 to 7 25	6 00 to 7 50	5 70 to 5 90	5 60 to 6 85	5 60 to 6 75
....	97 to 98	1 01 to 1 02	....	1 03	1 03 to 1 03½	1 04 to 1 06
1 24 to 1 24½	1 16½	1 16¼ to 1 16½	1 12	1 13 to 1 13¼	1 12 to 1 12¼	1 12½ to 1 14
65¼ to 66	58 to 59	61	62½	60½ to 61	57½	63 to 64
55 to 56	....	....	....	....	....	....
....	....	....	....	....	....	....
55 to 70	37 to 52	34½ to 50	31 to 42	32½ to 44	33 to 42	36 to 42½
75 to 77	66	68½ to 70	69 to 73	65¼	65¾ to 66¼	75
2 00 to 2 75	Nominal.....	1 25 to 1 75	1 00 to 1 50	1 00 to 1 37½	1 00 to 1 75	1 25 to 1 75
17 00 to 19 00	17 00 to 18 00	17 00 to 18 00	18 00 to 19 00	17 50	17 00	17 00 to 17 50
15 00 to 16 00	15 00 to 16 00	15 00 to 16 00	15 00 to 17 00	15 00 to 16 00	15 00	15 25
11 50 to 12 50	....	....	11 50 to 12 50	11 25 to 11 75	....	....
14 00 to 15 00	12 00 to 13 00	11 50 to 12 50	12 00 to 13 00	12 50 to 12 80	....	11 50 to 12 00
26 00 to 26 50	28 00 to 29 00	35 00	23 00 to 24 00	17 00 to 18 00	....	22 50

MARKET PRICES OF FARM

Product.	January.	February.	March.	April.	May.
NEW YORK—Continued.					
Pork:					
Extra prime ....bbl.	$14 00 to $15 00	$15 00	$15 25 to $15 50	$15 50 to $16 00	$16 25 to $16 50
Prime mess ....do.	16 50 to 17 00	$16 75 to 17 25	18 00 to 18 25	18 00 to 18 75	18 00 to 19 00
Lard ....cental.	9 75 to 11 10	11 25 to 11 85	10 50 to 11 90	10 50 to 11 79	10 50 to 11 99
Butter:					
Creamery ....lb.	30 to 44	22 to 39	22 to 41	17 to 31	17 to 31
Western dairy ....do.	20 to 30	17 to 25	17 to 25	....	....
State dairy ....do.	29 to 36	23 to 38	23 to 35	23 to 38	22 to 26
Cheese, State factory....do.	9 to 13 1/2	9 to 14	9 1/2 to 13 1/4	13 to 14 1/4	9 to 14 1/2
Sugar, fair to good refining ....lb.	6 7/8 to 7	6 3/4 to 6 7/8	7 to 7 1/8	7 to 7 1/8	7 to 7 1/8
Cotton:					
Ordinary to good ordinary (N. O. and Gulf) .....lb	7 7/8 to 8 5/16	7 13/16 to 9 1/16	7 13/16 to 9 1/16	7 5/8 to 8 7/8	7 13/16 to 9 1/16
Low middling to good middling (N. O. and Gulf) ....lb.	10 to 10 5/8	10 to 10 3/4	10 to 10 7/8	9 13/16 to 10 3/4	10 1/4 to 11 1/8
Tobacco:					
Common to fine leaf (light) ....lb.	6 1/4 to 12	....	....	6 1/4 to 12 1/2	6 1/4 to 12 1/2
Select leaf (light).....do.	12 1/2	....	....	....	12 to 14
Common to good lugs (light) ....lb.	5 to 6	....	....	5 to 6	5 to 6
Wool:					
Combing and delaine..lb.	42 to 47	42 to 46	43	44 to 50	42 1/2 to 45
California..........do.	17 1/2 to 20	15 to 16	19 1/2	11 to 18	10 to 21
Ohio and Pennsylvania.do.	37 to 43 1/2	37 1/2	33 1/4	41 to 44	40 to 44
BOSTON.					
Flour:					
Western superfine spring ....bbl.	3 25 to 3 75	3 50 to 4 00	3 50 to 4 00	3 50 to 4 00	3 50 to 4 00
Common extras ....do.	3 75 to 4 25	4 00 to 4 50	4 25 to 4 75	4 25 to 4 75	4 25 to 5 00
Patents, winter ....do.	6 00 to 6 75	6 25 to 7 25	6 50 to 7 25	6 75 to 7 00	6 25 to 7 25
Wheat:					
No. 2 white..........bush.	99 to 1 00	1 04 1/2 to 1 05	1 08 to 1 09	1 02 to 1 03	1 06 to 1 07 1/2
No. 2 red..........do.	1 09 1/2 to 1 10	1 15 1/2 to 1 16	1 23 to 1 24	1 21 to 1 22	1 22 to 1 22 1/2
Rye ....do.	75	73 to 75	83 to 85	80	75 to 78
Barley ....do.	....	75 to 1 00	85 to 1 05	85 to 1 05	86 to 1 04
Oats:					
No. 2 white..........bush.	50 to 51	52 to 53	56 to 57	57 to 57 1/2	56 1/4 to 57
No. 2 mixed ....do.	46 to 49	50 to 51	54 to 55	53 to 56	53 to 55
Corn, No. 2 mixed..........do.	60 to 65	....	....	....	....
Potatoes ....do.	60 to 90	75 to 95	80 to 95	75 to 1 05	75 to 95
Hay:					
Good..........ton.	15 00 to 17 00	15 00 to 16 00	15 00 to 16 00	15 00 to 16 00	15 00 to 16 00
Choice ....do.	18 00	17 00	17 00	17 00	17 00 to 18 00
Pork:					
Extra prime..........bbl.	16 50 to 17 00	16 50 to 17 00	16 00 to 17 00	16 50 to 17 00	17 00 to 17 50
New mess..........do.	19 00 to 19 50	19 50 to 20 00	20 00	19 75 to 20 00	20 25 to 20 50
Beef:					
Western extra ....bbl.	13 00 to 13 50	12 50 to 13 00	12 50 to 13 00	12 50 to 13 50	14 00 to 14 50
Family extra and plate.do.	15 00 to 17 00	14 00 to 15 50	15 50 to 16 50	15 50 to 16 50	16 00 to 16 75
Lard ....lb.	11 1/4 to 12	11 1/2 to 12	12 to 12 1/2	11 3/4 to 12	12 to 12 1/2
Butter:					
Northern creamery ... lb.	28 to 39	25 to 34	20 to 32	....	22 to 28
Western creamery....do.	48 to 42	23 to 37	20 to 37	25 to 30	24 to 29
Cheese:					
Northern factory......lb.	5 to 13	5 to 13	5 to 13	5 to 13	5 to 13 1/2
Western factory......do.	4 to 13 1/2	4 to 13 1/2	4 to 13 1/2	5 to 14 1/4	5 to 14
Sugar, fair to good refining..........lb.	7 to 7 1/4	6 3/4 to 6 7/8	7 to 7 3/4	7 to 7 1/4	6 15/16 to 7 1/6
Cotton:					
Ordinary to good ordinary (Gulf)..........lb.	7 3/4 to 9 1/4	7 1/2 to 9	7 5/8 to 9 1/8	7 1/2 to 9	7 7/8 to 8 7/8
Middling to middling fair..........lb.	10 1/4 to 11 1/4	11 1/4 to 11 1/2	10 1/4 to 11 1/2	10 1/2 to 11 1/2	10 3/8 to 11 3/4
Tobacco:					
Choice leaf..........lb.	13 to 16	13 to 16	13 to 16	13 to 16	13 to 16
Good western..........do.	10 to 13	10 to 13	10 to 13	10 to 13	10 to 13
Lugs..........do.	6 to 8	6 to 8	6 to 8	6 to 8	6 to 8
Wool:					
Picklock and XXX....lb.	44 to 45	45 to 46	45 to 47	Nominal.....	44 to 47
Pulled ....do.	15 to 50	15 to 45	16 to 45	....do.......	15 to 45
Combing and delaine..do.	20 to 48	25 to 48	24 to 48	....do.......	20 to 50

PRODUCTS FOR 1883—Continued.

June.	July.	August.	September.	October.	November.	December.
16 50 to $17 00	$16 00	$14 50 to $15 00	$14 50	$12 50 to $13 00	$12 00	$11 75 to $12 00
18 75 to 19 25	17 50	16 00 to 17 00	16 00	15 50 to 16 50	$15 00 to 16 00	15 50 to 16 00
10 00 to 11 61	$9 30 to 9 60	8 75 to 9 40	$8 00 to 9 10	7 75 to 8 50	7 25 to 8 05	8 17 to 8 75
15 to 20	15 to 24	15 to 23	15 to 23	19 to 30	19 to 30	26 to 38
....	11 to 17	11 to 16	11 to 16	12 to 20	13 to 21	17 to 26
18 to 20	18 to 22	18 to 21	18 to 21	21 to 26	21 to 26	28 to 31
9 to 12¼	7½ to 10½	8½ to 10¼	8 to 10½	9 to 12	10 to 12½	9¼ to 12⅝
4½ to 4⅝	6 11/16 to 6 13/16	6⅞	6¾	6½ to 6¾	6⅝ to 6¾	6⅜ to 6½
8 1/16 to 9 5/16	7⅝ to 8⅞	7 5/16 to 8 9/16	7 13/16 to 9 1/16	8⅝ to 9⅛	8 9/16 to 9 13/16	8 9/16 to 9 13/16
10½ to 11⅝	10 1/16 to 10 15/16	9¾ to 10⅝	10 to 10¾	10½ to 11¼	10 7/16 to 11 1/16	10 7/16 to 11 1/16
6½ to 12	6½ to 11½	6½ to 11	....	7¼ to 12	7½ to 12	....
12 to 13	12 to 14	12 to 14	....	12 to 14	12 to 14	....
5 to 6	5 to 6	5 to 6	....	6 to 7	6½ to 7½	....
....	....	....	....	....	....	....
16	....	....	....	....	....	....
....	....	....	36 to 38	36¼	....	....
3 25 to 4 00	3 00 to 3 75	3 00 to 3 75	3 50 to 4 00	3 25 to 3 75	3 00 to 3 50	3 00 to 3 50
4 25 to 4 75	4 00 to 4 75	4 00 to 4 75	4 25 to 4 75	4 00 to 4 50	3 75 to 4 25	3 75 to 4 25
6 25 to 7 25	6 00 to 7 00	4 00 to 7 50	7 00 to 7 10	6 50 to 6 62	6 00 to 6 50	6 00 to 6 75
1 04 to 1 06	1 00 to 1 01	1 01 to 1 02	....	1 03	1 01 to 1 02	1 04 to 1 06
1 19 to 1 20	1 16 to 1 16	1 16½ to 1 17	1 19½ to 1 20	1 12 to 1 12½	1 11¾ to 1 12	1 13 to 1 14
78 to 80	78 to 80	75 to 80	75 to 80	72 to 75	70 to 75	75 to 78
83 to 1 00	83 to 1 00	Nominal	Nominal	....	85 to 92	70 to 92
54 to 55	47 to 48	44 to 45	43 to 45	39 to 40	39½ to 40	42½ to 43
50 to 53	43 to 46	40 to 42	38 to 40	36 to 38	37 to 38	40 to 42
70 to 72	64 to 65	65 to 66	67 to 69	63 to 64	63 to 64	72 to 75
50 to 80	40 to 80	40 to 80	50 to 60	45 to 53	45 to 55	40 to 55
16 00 to 17 00	15 00 to 16 00	15 00 to 16 00	15 00 to 16 00	15 00 to 16 00	14 00 to 15 00	14 00 to 15 00
18 00 to 19 00	17 00 to 18 00	17 00	17 00 to 18 00	17 00	16 00 to 17 00	16 00
17 00 to 17 50	16 50 to 17 00	15 00	14 00 to 15 00	12 00 to 12 50	11 75 to 12 00	12 50 to 13 00
20 50 to 21 00	18 50 to 19 00	17 00 to 17 50	15 50 to 16 00	12 50 to 13 00	12 00 to 12 50	14 75
14 00 to 14 50	14 00 to 14 50	13 50 to 14 00	12 00 to 13 00	12 00 to 13 00	11 50 to 12 00	11 50 to 12 00
16 50 to 17 00	16 50 to 17 00	15 50 to 16 00	13 50 to 14 00	13 50 to 14 00	13 00 to 13 50	....
12 to 12½	10¼ to 10¾	9¾ to 10	9¼ to 9¾	8¼ to 8¾	8 to 8¼	8½ to 8¾
19 to 22	19 to 23	18 to 23	18 to 23	23 to 30	23 to 30	24 to 35
19 to 22	19 to 23	18 to 22	18 to 22	22 to 30	22 to 31	23 to 36
....	....	8 to 10	7½ to 9½	8 to 12	9 to 12½	9 to 12¾
5 to 13	....	5 to 9½	5 to 9	5 to 11¼	5 to 12	5 to 12½
7⅛ to 7¼	6¾ to 6⅞	6⅝ to 6¾	6⅝ to 6¾	6⅜ to 6¾	6¾ to 6⅞	6¾ to 6⅞
7⅞ to 9⅜	7⅜ to 8⅞	7⅝ to 8⅞	7⅞ to 9⅛	8⅜ to 9⅞	8⅜ to 9⅞	8⅜ to 9⅞
10⅞ to 12¼	10⅞ to 11⅜	10⅜ to 12½	10½ to 11⅝	10⅝ to 12	10⅜ to 11¾	10⅝ to 11¾
13 to 16	13 to 16	13 to 16	11 to 13	11 to 13	11 to 13	12 to 13
10 to 13	10 to 13	10 to 13	10 to 12	10 to 12	10 to 12	10 to 12
6 to 8	6 to 8	6 to 8	5½ to 9	5½ to 9	5½ to 9	5½ to 9
42 to 43	42 to 43	40 to 42	40 to 42	42 to 43	42 to 43	43 to 44
15 to 40	15 to 45	15 to 42	15 to 38	15 to 43	15 to 43	20 to 43
20 to 45	20 to 45	20 to 42	20 to 44	20 to 45	20 to 46	28 to 45

MARKET PRICES OF FARM

Product.	January.	February.	March.	April.	May.
PHILADELPHIA.					
Flour:					
Superfine, Western and Pennsylvania ......bbl.	$3 00 to $3 25	$3 00 to $3 37½	$3 75 to $4 00	$3 75 to $4 00	$3 50 to $3 75
Minnesota "straight".do.	5 60 to 6 25	6 00 to 6 50	6 25 to 7 00	6 00 to 6 50	6 00 to 6 50
Winter patents	5 10 to 7 00	6 50 to 7 25	6 50 to 7 50	6 50 to 7 50	6 50 to 7 25
Spring patents	5 40 to 7 25	7 00 to 7 75	7 00 to 8 00	7 00 to 8 00	7 00 to 7 75
Wheat:					
No. 2 red ....bush.	1 08¼	1 14½	1 18 to 1 24	1 20	1 16 to 1 25
Corn, sale, new..........do.	50 to 78	60 to 67	61 to 70	56 to 66	61 to 67
Rye.....................do.	64 to 67	65	70 to 72	68 to 70	70 to 72
Oats ....do.	45 to 49	45 to 51	51 to 57	50 to 55	49 to 54
Potatoes ....do.	75 to 1 00	70 to 90	71 to 95	70 to 90	70 to 90
Hay, timothy ....ton.	18 00 to 20 00	18 00 to 20 00	18 00 to 21 00	18 00 to 20 00	18 50 to 20 00
Beef:					
Family................bbl.	15 00 to 15 75	15 50 to 16 00	15 50 to 16 00	15 50	15 50 to 16 00
India mess.............do.	27 00	26 50	26 50	26 50	27 00
Hams...................do.	18 00 to 19 00	19 00 to 20 50	20 00 to 21 00	21 00 to 23 00	22 00 to 23 00
Pork:					
Mess ....bbl.	19 00 to 19 50	18 75 to 19 00	19 50 to 20 00	19 50 to 19 75	20 50 to 21 00
Prime mess............do.	18 00	18 00	18 00	18 00 to 18 50	19 00 to 19 50
Lard ....cental.	10 50 to 11 75	10 50 to 11 75	10 75 to 11 75	11 62½ to 12 00	11 00 to 12 00
Butter:					
Creamery ....lb.	30 to 42	30 to 37	20 to 31	17 to 33	16 to 30
Western dairy ....do.	18 to 30	17 to 25	16 to 25	15 to 25	15 to 22
Cheese:					
New York factory.... lb.	....	14 to 14½	12 to 14	12 to 14	12
Ohio ....do..	9 to 13	12 to 13½	11 to 14	10 to 14	10 to 12
Sugar, fair to good refining ....lb.	6 15/16 to 7 1/16	6⅞ to 7	7 to 7½	7 to 7¼	7 to 7⅛
Cotton:					
Middling uplands .....lb.	....	10½	10½	10½	10⅞ to 11
N. Orleans and Texas.do..	....	10¾	10¾	10¾	11½
BALTIMORE.					
Flour:					
Ohio and Indiana superfine ....bbl.	3 15 to 3 50	3 25 to 3 75	3 50 to 4 37	3 37 to 4 00	3 25 to 4 00
Ohio and Indiana family ....bbl.	4 50 to 5 50	5 00 to 5 50	5 35 to 6 00	5 12 to 6 00	5 00 to 5 75
Patents, Baltimore winter ....bbl.	7 00	7 25	7 50	7 50	7 50
Wheat, No. 2, red .....bush.	1 09 to 1 09⅞	1 15⅝ to 1 15¾	1 21½	1 19½	1 19⅞ to 1 20⅛
Corn, regular mixed, Western ....bush.	63 to 64¼	68 to 73	69¾ to 70	66½ to 67	67 to 68
Rye..................... do.	66 to 68	68 to 72	73	65 to 70	67 to 70
Oats ....do.	44 to 48	47½ to 51	50 to 54	50 to 54	51 to 55
Potatoes ....do.	85 to 1 00	70 to 90	75 to 90	80 to 95	80 to 90
Hay, timothy ....ton.	11 00 to 18 00	12 00 to 19 00	11 00 to 19 00	11 00 to 19 00	12 00 to 19 00
Pork:					
Mess...................bbl.	18 50	19 00	20 00	20 00	20 50
Bacon, shoulders ......lb.	9¼	9¼	9¾	9¾	10
Sugar-cured hams .....do.	13¾ to 14½	13¾ to 14½	14 to 15	14 to 15	14½ to 15½
Sugar-cured shoulders.do.	9¼	9¾	10	10	10½
Lard, refined.........cental.	11 50	12 00	12 50	12 25	12 25
Butter:					
Creamery ....lb.	30 to 40	25 to 38	25 to 42	23 to 35	22 to 30
New York State, good to choice.................lb.	30 to 35	25 to 33	25 to 33	22 to 30	21 to 26
Western factory ......do.	23 to 27	17 to 21	19 to 23	16 to 20	16 to 20
Cheese:					
New York choice......lb.	14½	14	14	14¼ to 15	14½ to 15½
Western choice ....do.	13¼ to 13½	13¼ to 13½	13¼ to 13½	13½ to 14	10½ to 11
Sugar, fair refining .....do.	6¾	7¾	6¾ to 7¼	7 to 7⅛	6¾ to 7 1/16
Cotton:					
Ordinary to good ordinary ....lb.	7½ to 8¾	7½ to 8¾	7½ to 8¾	8½	7 to 8½
Low middling to middling ....lb.	9½ to 10½	9½ to 10½	9⅝ to 10⅛	9⅜ to 10	9¼ to 10½
Tobacco:					
Good to middling, Maryland leaf ....cental.	4 00 to 8 00	4 00 to 8 00	4 00 to 8 00	4 00 to 8 00	4 00 to 8 00
Common to medium, Kentucky leaf.......cental.	7 50 to 10 00	7 50 to 10 00	7 50 to 10 00	7 50 to 10 00	7 50 to 10 00
Common to good, Kentucky lugs ....cental.	5 00 to 7 00	5 00 to 7 00	5 00 to 7 00	5 00 to 7 00	5 00 to 7 00
Common to good, Virginia lugs ....cental.	3 00 to 5 50	3 00 to 5 50	3 00 to 5 50	3 00 to 5 50	3 00 to 5 50
Wool:					
Burry ....lb.	21 to 22	21 to 22	....	....	....
Merino, unwashed ....do.	23 to 27	23 to 27	23 to 27	23 to 26	25 to 28
Merino, washed........do.	27 to 30	27 to 30	35 to 38	35 to 38	....
Tub-washed ....do.	37 to 40	36 to 40	36 to 40	36 to 40	35 to 38

PRODUCTS FOR 1883—Continued.

June.	July.	August.	September.	October.	November.	December.
$3 50 to $3 75	$3 50 to $3 75	$3 50 to $3 75	$3 30 to $3 75	$3 25 to $3 62½	$3 25 to $3 62½	$3 00 to $3 50
5 75 to 6 50	5 75 to 6 25	5 75 to 6 00	5 75 to 6 25	6 25 to 6 50	6 00 to 6 25	5 65 to 6 00
6 50 to 7 00	6 50 to 7 00	6 50 to 7 00	6 50 to 6 75	6 25 to 7 00	6 25 to 7 00	6 00 to 6 75
7 00 to 7 50	7 00 to 7 25	7 00 to 7 25	6 75 to 7 00	6 50 to 7 50	6 56 to 7 50	6 37½ to 7 00
1 21	1 13¾	1 14½	1 13	1 09½ to 1 11	1 06½ to 1 07	1 09 to 1 15
60 to 67	55 to 63	56 to 66	56 to 65	58 to 61	55 to 60	58½ to 63
70 to 73	65 to 67	63 to 65	62 to 64	60 to 61	65 to 67	65
45 to 50	39 to 44	41 to 45	38 to 44	34 to 37	34 to 36½	38 to 41
18 00 to 19 75	19 00 to 21 00	19 00 to 20 00	18 00 to 19 50	16 00 to 18 00	12 00 to 15 50	14 00 to 15 50
15 50 to 16 00	15 00	14 00 to 14 50	13 75 to 14 25	13 50 to 14 00	13 00 to 13 50	13 00 to 13 50
26 75	23 00	18 50 to 19 50	18 50 to 19 50	19 00 to 19 50	21 50 to 22 00	23 00
25 00 to 26 00	26 50 to 27 00	25 00	20 00 to 21 00	19 00	20 00 to 20 25	23 50 to 24 00
21 00	19 00 to 19 50	16 50 to 17 50	15 00 to 15 75	13 00 to 13 50	14 00 to 14 50	15 00
20 00 to 20 50	18 00 to 18 50	16 00 to 16 50	16 00	16 00	14 00 to 14 50	14 00 to 14 50
11 00 to 12 25	10 00 to 10 50	9 50 to 10 25	9 00 to 10 00	8 50 to 9 25	7 50 to 8 75	8 00 to 8 75
15 to 28	15 to 24	20 to 23	17 to 25	18 to 29	......	......
12 to 18	11 to 17	13 to 17	13 to 18	12 to 20	......	......
10 to 11	9 to 10¾	9¾ to 10¾	10 to 11	10¾ to 11½	......	......
9 to 10	7 to 8	7½ to 9	7¾ to 10	7½ to 11	......	......
7⅛ to 7¼	6¾ to 6⅞	6⅝ to 6¾	6⅜ to 6½	6⅝ to 6¾	6¼ to 6⅞	6⅝ to 6¾
11⅛ to 11⅜	10¾	10½	10⅝	10⅞	10¾	10⅝
11⅜	11	10¾	10⅞	11⅛	11	10⅞
3 25 to 4 00	3 25 to 4 00	3 25 to 3 75	3 25 to 3 75	3 25 to 3 65	3 25 to 3 65	3 25 to 3 70
5 12 to 5 75	5 25 to 7 55	5 25 to 5 50	5 25 to 5 50	5 00 to 5 50	5 00 to 5 50	5 25 to 5 50
7 50	7 50	7 50	7 50	7 00	7 00	7 00
1 22⅝ to 1 22¾	1 14 to 1 14⅛	1 13⅞ to 1 14	1 14¾ to 1 15	1 06½ to 1 06¾	1 04⅜ to 1 04¾	1 08½
64⅜ to 64½	58⅞	59¾	60 to 61¼	59¾	58	60½ to 60¾
68 to 70	65 to 68	56	67	60 to 63	65	66 to 68
48 to 53	41 to 46	37 to 43	30 to 38	35 to 40	34 to 38	37 to 41
75 to 1 00	75	......	50 to 60	45 to 60	40 to 50	35 to 50
10 00 to 18 00	10 00 to 17 00	12 00 to 19 00	13 50 to 16 00	14 00 to 18 00	13 00 to 17 00	13 00 to 15 00
20 75	18 50	16 50	15 00	13 50	12 75	13 75
10	9¼	8¾	8¼	7¾	7	7
14¾ to 15½	15 to 16	14¾ to 16	15¾ to 16¼	15¾ to 16¼	16 to 17	14½ to 15
10½	10	10	10	8¾	8¾	......
12 25	11 25	10 75	10 25	10 00	9 25	9 25
18 to 33	18 to 24	18 to 24	18 to 24	25 to 30	25 to 30	25 to 44
18 to 20	17 to 23	17 to 23	17 to 23	20 to 26	20 to 26	23 to 32
14 to 18	13 to 16	13 to 16	13 to 16	......	20 to 22	20 to 22
12 to 12¾	11½ to 11¾	11¼ to 11½	11¼ to 11½	11¾ to 12	12½ to 12¾	12 to 12¼
12 to 12½	9½ to 10	9 to 9½	9 to 9½	10½ to 11	12 to 12½	12 to 12½
7 1/16 to 7⅜	......	6¼ to 6¾	6⅜ to 6⅝	6⅜ to 6⅝	6½ to 6⅞	6½ to 6¾
8 to 8¾	7¼ to 8½	7 to 8¼	8 to 8½	9	9⅜	8⅜ to 9⅜
10⅛ to 10⅝	9¼ to 10¼	9½ to 10	9⅝ to 10⅛	9⅞ to 10⅜	10 to 10⅜	9⅞ to 10⅜
4 00 to 8 00	4 00 to 8 00	4 00 to 8 00	5 50 to 8 50	5 50 to 8 50	5 50 to 8 50	5 50 to 8 50
7 50 to 10 00	7 50 to 10 00	7 50 to 10 00	7 50 to 10 00	7 50 to 10 00	7 50 to 10 50	7 50 to 10 00
5 00 to 7 00	5 00 to 7 00	5 00 to 7 00	5 00 to 7 00	5 00 to 7 00	5 00 to 7 00	5 00 to 7 00
3 00 to 5 50	3 00 to 5 50	3 00 to 5 50	3 00 to 5 50	3 00 to 5 50	3 00 to 5 50	3 00 to 5 50
......	......	......	......	......	......	......
26 to 28	25 to 28	25	25	24 to 26	......	......
......	......	......	......	......	24 to 26	......
35 to 40	35 to 38	35 to 38	25 to 38	33 to 37	33 to 37	......

MARKET PRICES OF FARM

Product.	January.	February.	March.	April.	May.
BALTIMORE—Continued.					
Rice:					
Carolina, common to choice ... lb.	$0 05¼ to $0 06⅝	$0 05¼ to $0 07	$0 05¼ to $0 07	....	$0 05¼ to $0 07
Louisiana, common to fair ... do.	5 to 6	5 to 6	5 to 6	....	5 to 6
CHICAGO.					
Flour:					
Winter ... bbl.	....	....	5 40	....	5 00
Spring ... do.	5 00	4 76 to 4 85	5 50	$6 90	....
Wheat:					
No. 2 spring ... bush.	93⅜ to 94⅝	1 04 to 1 04⅞	1 10¼ to 1 10½	1 07⅞	1 11 to 1 11¼
No. 2 red winter ... do.	95	1 04½	1 08 to 1 08¾	1 09½	1 12 to 1 12¼
Barley ... do.	....	83	80	76	80 to 83
Corn, No. 2 ... do.	49½ to 50	54⅛ to 55½	56¼ to 57⅝	54⅛	55¼ to 55½
Oats, No. 2 ... do.	39 to 41½	37⅛ to 37⅜	41⅛ to 41⅜	$0 42 to 42½	40 to 40½
Rye, No. 2 ... do.	57½	63	65	58½	60½
Potatoes ... do.	75 to 90	70 to 75	73 to 75	63 to 75	45 to 60
Hay:					
Timothy, first quality ... ton.	10 00 to 11 50	10 00 to 11 00	11 00 to 12 00	10 50 to 11 00	10 75 to 11 00
Timothy, second quality ... ton.	11 50 to 13 00	11 50 to 12 50	10 00 to 11 00	9 50 to 10 00	10 00 to 10 50
Beef:					
Mess ... bbl.	10 00 to 10 25	10 50 to 10 75	11 50 to 11 75	11 75 to 12 00	12 00 to 12 25
Hams ... do.	17 00 to 17 50	18 50 to 19 25	20 50 to 21 00	20 75 to 21 25	21 00 to 21 50
Pork:					
Mess ... bbl.	17 10 to 17 15	17 50 to 17 90	18 05 to 18 15	18 30	19 45
Bacon, short clears ... cental.	10 25 to 11 00	10 50 to 11 00	10 75 to 11 00	11 25 to 11 50	11 75 to 12 00
Hams, sweet pickled ... do.	10 25 to 10 50	10 50 to 11 00	10 75 to 11 25	11 25 to 11 50	12 00 to 12 37½
Lard ... do.	10 40	11 00	11 40	11 32½	11 00 to 11 62½
Butter:					
Creamery ... lb.	24 00 to 40 00	24 00 to 37 00	32 00 to 40 00	23 00 to 31 00	24 00 to 30 00
Good to choice dairy ... do.	24 00 to 37 00	24 00 to 30 00	24 00 to 32 00	14 00 to 23 00	15 00 to 23 00
Cheese:					
Full cream ... lb.	11½ to 12½	11½ to 12	11 to 14	14½ to 15½	14½ to 15½
Lower grades ... do.	2 to 9	2 to 9	2 to 9½	3 to 12	3 to 12
Sugar, yellow ... do.	6¼ to 7¼	6¼ to 7⅛	7 to 8	7½ to 7⅝	7½ to 7⅞
CINCINNATI.					
Flour:					
Superfine ... bbl.	3 00 to 3 35	3 60 to 3 90	3 50 to 3 85	3 40 to 3 65	3 40 to 3 75
Extra ... do.	3 50 to 3 75	4 20 to 4 60	4 25 to 4 60	5 15 to 5 65	4 10 to 4 35
Family ... do.	4 10 to 4 25	5 00 to 5 25	4 90 to 5 00	4 65 to 4 75	4 75 to 5 00
Fancy ... do.	4 75 to 5 25	5 50 to 6 00	5 35 to 5 75	5 15 to 5 65	5 35 to 5 85
Wheat:					
No. 3 red winter ... bush.	90	98	1 08 to 1 09	....	....
No. 2 red winter ... do.	95	1 06	1 10 to 1 12	1 07 to 1 10	1 12
Corn:					
No. 2 mixed ... bush.	48½ to 49	54	56 to 56½	55½ to 56	55¾ to 56
No. 2 white ... do.	....	....	....	....	....
No. 2 yellow ... do.	50	55	....	....	....
Oats ... do.	36½ to 40	42 to 44	42½ to 46	42 to 48	45 to 48½
Rye ... do.	62	65½ to 67	67	62 to 63½	65
Barley ... do.	61½ to 62	63 to 73	50 to 65	59 to 63	60 to 68
Hay:					
No. 1 timothy ... ton.	12 50 to 13 00	12 00 to 12 50	12 00 to 12 50	11 50 to 12 00	11 50 to 12 50
Lower grades ... do.	8 50 to 12 00	8 00 to 11 50	7 00 to 11 50	7 00 to 10 50	6 00 to 10 50
Pork:					
Mess ... bbl.	17 25 to 17 50	17 50 to 17 75	18 50 to 19 00	18 75	19 75 to 20 00
Hams, sugar-cured ... lb.	12½ to 13½	12 to 13	12½ to 13½	12 to 13½	12½ to 13¾
Sho'lders, sugar-cured ... do.	8½ to 8¾	7½ to 8	8½ to 8¾	8¾ to 9	9¼ to 9½
Bacon, sugar-cured ... do.	11½ to 12½	11¼ to 12	12 to 13½	11¾ to 13	12 to 13
Lard ... cental.	10 00⅞ to 10 07½	10 40 to 10 55	11 17½ to 11 20	11 00 to 11 25	11 20 to 11 35
Butter:					
Creamery ... lb.	35 to 45	30 to 40	30 to 45	32 to 35	25 to 30
Lower grades ... do.	15 to 25	13 to 25	12½ to 25	12 to 25	8 to 20
Cheese:					
Choice Ohio factory ... lb.	12 to 12½	12 to 13	11 to 14	13¼ to 14	11½ to 12
Lower grades ... do.	9 to 11½	9 to 11½	10 to 12½	10 to 12	8 to 10
Potatoes ... bush.	70 to 1 00	70 to 1 00	75 to 1 00	90 to 1 10	40 to 75
Peanuts:					
Tennessee ... lb.	3¾ to 4½	3¾ to 4½	4½ to 5	4½ to 6	4¾ to 6
Virginia ... do.	5¾ to 6	6¾ to 7¾	6¾ to 7¾	6¾ to 7	6¾ to 7¾
Cotton:					
Ordinary to good ordinary ... lb.	7¼ to 8¾	7½ to 8¾	7½ to 8¾	7½ to 8¾	7⅝ to 8⅝
Low middling to good middling ... lb.	9¼ to 9⅞	9¼ to 9⅞	9⅜ to 9⅞	9⅜ to 10	9½ to 10½
Middling fair to fair ... do.	10½ to 11¾	10⅝ to 11⅜	10¾ to 11½	10¾ to 11½	11⅝ to 12⅜

PRODUCTS FOR 1883—Continued.

June.	July.	August.	September.	October.	November.	December.
$0 05¼ to $0 07	$0 05¼ to $0 07¼	$0 05¼ to $0 07¼	$0 05¼ to $0 07¼	$0 05⅝ to $0 06¼	$0 05⅜ to $0 06¾	$0 05⅜ to $0 07
5 to 6	......	......	......	6 to 7	......	......
4 25	......	2 75	4 50	5 15	5 15	......
3 75 to 5 50	4 55 to 5 75	......	......	4 15	4 15	4 00
1 13¼	90¾ to 1 00½	87	99 to 99¼	95¼ to 95½	91⅛ to 92⅞	97⅜ to 98⅜
1 15	1 07½	1 07	1 06	1 02 to 1 02½	97½ to 98	99½ to 1 01
80	70	77	62	61 to 63½	......	......
56⅛ to 56¼	48¾ to 49½	51 to 51¾	49 to 49⅜	49⅜ to 49⅝	46⅜ to 47	54¼ to 55
39¼ to 39½	33½ to 33¾	28¾ to 29	25⅝ to 26	27¾ to 28	27¼ to 28	30½ to 31½
64½	55 to 55½	57½ to 58¼	55½	56	56	52 to 58
45 to 60	45 to 50	40 to 50	30 to 36	35 to 40	35 to 40	25 to 40
11 50 to 12 50	11 00 to 11 50	12 00 to 12 50	11 75 to 12 00	10 00 to 11 00	10 00 to 10 50	9 50 to 10 50
10 50 to 11 50	9 00 to 10 00	10 00 to 11 50	9 00 to 10 00	8 00 to 9 00	9 00 to 9 50	9 00 to 9 50
12 25 to 12 50	11 75 to 12 00	......	10 00 to 10 50	10 00 to 10 25	10 00 to 10 50	10 25 to 10 50
24 00 to 24 50	24 00 to 24 50	......	20 00 to 21 00	16 75 to 17 00	......	22 50 to 23 00
19 27½ to 19 37½	15 77½ to 16 10	15 00 to 16 00	12 00 to 14 00	10 37½ to 10 67½	10 25 to 10 35	13 00
11 75 to 12 00	9 75 to 10 00	9 60 to 10 00	7 50 to 8 00	7 00 to 7 25	9 00 to 10 00	7 75 to 8 00
11 75 to 12 00	10 50 to 11 00	10 75 to 11 50	11 75 to 12 00	11 50 to 12 25	13 00 to 13 25	10 00 to 11 00
11 60 to 11 75	9 12½ to 9 30	8 35	8 27½ to 8 35	7 80 to 7 87½	7 20 to 7 22½	8 27½ to 8 30
18 to 22	18 to 22	16 to 21	18 to 23	22 to 29	25 to 29	32 to 41
14 to 20	14 to 20	13 to 17	13 to 18	16 to 23	16 to 24	25 to 35
12 to 12½	9 to 10	9 to 9½	8½ to 10¾	11¼ to 12½	11 to 11¾	12¼ to 13½
3 to 10½	1 to 6	1 to 6	3½ to 5½	3 to 10	2 to 8	3 to 10
7½ to 7⅞	7⅛ to 7¾	6¾ to 7⅝	6¾ to 7½	6¾ to 7½	6½ to 7¾	6½ to 7
3 50 to 3 75	3 22 to 3 50	3 00 to 3 15	2 90 to 3 25	3 10 to 3 40	2 25 to 3 25	2 90 to 3 25
4 25 to 4 60	4 00 to 4 50	3 60 to 4 00	3 60 to 4 00	3 65 to 4 00	3 45 to 3 75	3 50 to 3 75
4 95 to 5 25	4 75 to 5 00	4 75 to 5 50	4 60 to 4 75	4 75 to 4 90	4 50 to 5 00	4 50 to 4 85
5 50 to 6 00	5 50 to 5 75	5 25 to 5 75	5 40 to 6 00	5 35 to 5 60	5 20 to 5 50	5 00 to 5 40
......	1 02 to 1 05	1 02	1 00 to 1 03	96 to 1 03	1 02	93 to 1 00
1 15	1 10 to 1 12	1 05 to 1 06	1 06 to 1 06¼	1 05 to 1 05½	1 05 to 1 08	1 05
54	53	50	51½	51⅛ to 51⅝	50	57
......	52	51	52½	52	52	......
......	52	51	52½	52	......	......
42 to 47	40 to 42	32 to 36	28 to 31	30 to 31½	30⅛ to 32	33 to 35½
62½ to 63½	60 to 62½	51½ to 54½	54 to 56	57 to 58	60 to 61	60 to 61
65 to 75	Nominal	Nominal	60 to 62	60 to 70	63 to 67	55 to 70
12 00 to 13 00	12 00 to 12 75	11 50 to 12 00	11 00	10 50 to 11 00	10 50	10 00 to 10 50
7 00 to 11 00	7 00 to 11 50	10 00 to 10 50	8 00 to 10 50	10 00 to 10 50	9 50 to 10 00	7 00 to 9 50
20 00	19 00 to 19 25	15 00 to 15 50	13 00 to 13 25	11 50 to 11 75	11 00 to 11 50	13 50 to 14 25
12¾ to 14	12¾ to 13¼	13¾ to 14¾	13½ to 14½	14½ to 15	14 to 14½	13 to 14
9¾ to 10	9 to 10½	9¼ to 9½	8¾ to 9¼	8 to 8½	7½ to 8	7 to 7½
12½ to 13½	12 to 13	12 to 13	12 to 12½	10 to 10½	9 to 9½	8½ to 9
11 05 to 11 15	10 00 to 10 85	8 30	8 12 to 8 15	7 60	7 40 to 7 50	8 10 to 8 30
17 to 22	19 to 23	21 to 23	21 to 23	30	25 to 32	45
7 to 16	8 to 16	15 to 20	14 to 20	16 to 22	12 to 25	16 to 25
10 to 11	9 to 10	9 to 10	8 to 8½	10 to 11	9 to 11	10½ to 11½
......	......	......	7 to 7½	8½ to 9	7 to 10	7 to 10
60 to 1 00	60 to 75	35 to 40	35 to 40	35 to 40	25 to 35	35 to 40
6¼ to 8	6¼ to 7½	6½ to 7¼	7¼ to 7½	8½ to 9	5¾ to 6¼	4¾ to 6¾
8½ to 9¼	8½ to 9¼	8½ to 9	......	......	......	......
7¾ to 9	7⅜ to 9	7⅜ to 8⅝	7⅝ to 8⅞	8 to 9¼	7⅞ to 9⅛	8⅛ to 9¼
9¾ to 10⅝	9½ to 10½	9⅜ to 10⅛	9⅝ to 10⅜	10 to 10⅝	9⅞ to 10⅜	9⅞ to 10⅜
11⅛ to 12¼	11¼ to 11¾	11 to 11¾	11 to 12	11⅛ to 12¼	11 to 11⅝	11 to 11⅝

MARKET PRICES OF FARM

Product.	January.	February.	March.	April.	May.
CINCINNATI—Continued.					
Wool:					
Fleece, washed	$0 33 to $0 37	$0 33 to $0 38	$0 36 to $0 40	$0 35 to $0 40	$0 35 to $0 38
Tub washed	28 to 36	26 to 36	26 to 37	26 to 37	26 to 37
Unwashed	15 to 24	15 to 24	15 to 25	15 to 25	15 to 25
Pulled	26 to 27	26 to 27	28 to 30	28 to 30	28 to 30
SAINT LOUIS.					
Flour:					
Superfine ....bbl.	2 60 to 2 70	2 80 to 2 90	3 00 to 3 10	2 90 to 3 00	2 90 to 3 10
Family ....do.	3 90 to 4 00	4 10 to 4 20	4 50 to 4 65	4 60 to 4 70	4 65 to 4 75
Patents ....do.	5 35 to 6 25	5 50 to 6 25	5 90 to 7 00	5 60 to 6 75	5 75 to 6 80
Wheat, No. 2 red ....bush.	96½ to 96⅝	1 04 to 1 04½	1 11 to 1 11¾	1 09 to 1 09¼	1 11 to 1 12½
Corn, No. 2 mixed ....do.	44½	47½ to 48½	53¼ to 53¾	48 to 48¼	50 to 51
Rye ....do.	....	58½	55 to 60	....	....
Barley ....do.	....	60 to 65	60 to 65	....	....
Oats ....do.	36 to 36¼	37 to 37⅜	39½ to 40½	42¼ to 43	41 to 42½
Potatoes ....do.	85 to 92	75 to 85	....	....	....
Hay:					
Timothy ....ton.	12 00 to 15 00	11 00 to 13 00	11 75 to 14 00	12 00 to 14 00	11 75 to 13 75
Prairie ....do.	8 50 to 10 00	7 00 to 8 50	7 50 to 9 25	7 50 to 9 50	8 50
Pork:					
Mess ....bbl.	16 50 to 17 00	17 40 to 18 00	18 37½ to 19 00	18 25 to 19 00	19 00 to 19 40
Bacon, breakfast, sugar-cured ....lb.	13¼ to 14	12½ to 13	13 to 13½	12 to 13	12 to 13½
Hams, sugar-cured ....do.	13¼ to 14	13 to 14	13 to 14	....	....
Lard, refined, in tierces ..do.	11 to 12	11½ to 11¾	11¾ to 12	11¾ to 12	11¾ to 12
Beef:					
Extra mess ....bbl.	....	....	....	12 00 to 16 00	12 00 to 16 00
Family extra ....½bbl.	7 00 to 8 50	7 00 to 8 50	7 00 to 8 50	....	....
Butter:					
Creamery ....lb.	35 to 40	30 to 37	30 to 37	30 to 38	22 to 25
Dairy ....do.	30 to 34	20 to 30	20 to 30	20 to 28	12 to 20
Cheese:					
Creamery ....do.	12½ to 14	12½ to 14	13 to 15	13 to 14	13½ to 14
Lower grades ....do.	3 to 8¼	3 to 8¼	2 to 9	2 to 9	4 to 9
Tobacco:					
Common to good, lugs burley ....cental.	4 50 to 7 00	....	4 00 to 6 00	4 00 to 6 00	4 00 to 6 00
Common to medium leaf, burley ....cental.	6 50 to 12 00	....	6 00 to 11 00	6 00 to 11 00	6 00 to 11 00
Good to fine leaf ....do.	8 00 to 20 00	....	13 00 to 18 00	13 00 to 18 50	13 00 to 18 25
Wool:					
Tub washed ....lb.	27 to 33	28 to 35	30 to 37	30 to 35	29 to 35
Unwashed ....do.	20 to 24	17½ to 26	17 to 26	17 to 25	17 to 26
Peanuts ....do.	3½ to 5	4 to 5½	4 to 5¼	4¼ to 5¼	4½ to 5½
Sugar, New Orleans, common to choice ....lb.	6¼ to 7¼	6¼ to 7½	6¾ to 7½	....	7½ to 8
Cotton:					
Ordinary to good ordinary ....lb.	7⅝ to 8⅝	7⅝ to 8⅝	7½ to 8⅜	7¼ to 8⅛	8¾ to 8⅛
Low middling to good middling ....lb.	9⅛ to 9 13/16	9¼ to 10¼	....	8⅞ to 10	9 to 10¼
KANSAS CITY.					
Flour:					
Choice ....sack.	1 90 to 2 00	1 90 to 2 00	2 15 to 2 20	2 20 to 2 30	2 30 to 2 40
Fancy ....do.	2 10 to 2 20	2 10 to 2 20	2 25 to 2 35	2 35 to 2 45	2 35 to 2 45
Wheat:					
No. 1 red winter ...bush.	83 to 84	92½	1 02 to 1 03	1 04 to 1 05	1 07 to 1 08½
No. 2 red winter ....do.	79 to 79¼	88¼	95½ to 96	95¾	95⅞
Corn, No. 2 mixed ....do.	37¾	41	45	44½ to 44⅜	42½ to 4[illegible]⅝
Rye ....do.	43½ to 44½	52½	52½	45 to 48½	49 to 51
Barley ....do.	....	....	....	....	....
Oats ....do.	33¾ to 34¼	33¼ to 34	35	....	40
Potatoes ....do.	65 to 85	65 to 85	65 to 90	55 to 1 00	25 to 60
Hay, baled	5 50 to 7 75	5 50 to 7 00	5 25 to 7 75	4 25 to 6 50	4 50 to 7 25
Pork:					
Mess ....bbl.	19 00	19 00	19 00	19 00	20 00
Clear ....do.	23 00	23 00	23 00	23 00	24 00
Hams, sugar-cured ....lb.	14½	13	12½	12¾	13
Bacon, breakfast ....do.	14½	13	12½	13¼	14½
Lard, tierce ....do.	13¼	10¼	11¾	11¼	11½
Butter:					
Creamery ....do.	30 to 35	25 to 35	25 to 32	28 to 32	25 to 30
Dairy, Kansas ....do.	22 to 24	22	22	23 to 25	21 to 25
Cheese:					
Full cream ....do.	12 to 12½	14	14½	14½	14
Young America ....do.	14½ to 15	15	16	16½	15
Peanuts, Kansas ....do.	3 to 4	3 to 4	....	....	....
Wool:					
Unwashed ....do.	17 to 21	17 to 21	17 to 21	17 to 21	17 to 21
Tub-washed ....do.	30 to 32	30 to 32	30 to 32	30 to 32	30 to 32

PRODUCTS FOR 1883—Continued.

June.	July.	August.	September.	October.	November.	December.
$0 25 to $0 36	....	....	....	....	....	....
28 to 36	....	....	....	....	....	....
18 to 25	....	....	....	....	....	....
25 to 28	....	....	....	....	....	....
3 00 to 3 10	$2 60 to $2 75	$2 50 to $2 65	$2 40 to $2 55	$2 65 to $2 80	$2 65 to $2 80	$2 60 to $2 75
4 95 to 5 20	4 40 to 4 50	4 25 to 4 40	4 00 to 4 15	4 10 to 4 25	4 00 to 4 15	3 90 to 4 10
6 30 to 6 90	6 00 to 6 75	6 00 to 6 50	5 85 to 6 50	5 75 to 6 50	5 75 to 6 50	5 75 to 6 50
1 19¼ to 1 20	1 07¾ to 1 08½	1 04¾ to 1 05	1 03⅞ to 1 04⅞	1 00¾ to 1 01¼	99⅝ to 1 00⅝	1 01⅞ to 1 03
51⅛ to 51⅝	44½ to 45	48	45¾ to 46½	46½ to 46⅝	42⅞ to 43⅛	45¾ to 46¼
59 to 61	58 to 60	55 to 58	52¾ to 53	48 to 55	....	45 to 53½
....	....	....	....	....	....	35 to 55
40⅜ to 40½	33 to 35	30 to 31	25¼ to 26	25¾ to 26½	26½ to 26¾	28¾ to 29
55 to 80	40 to 75	30 to 75	30 to 70	40 to 45	33½ to 40	30 to 40
11 50 to 14 00	11 50 to 14 00	10 50 to 13 00	9 00 to 12 00	9 00 to 12 00	8 00 to 12 00	7 00 to 12 50
8 50	8 50	8 00 to 8 75	8 00 to 8 75	8 25	10 00 to 11 00	10 00 to 10 50
19 40 to 19 70	17 00 to 17 75	14 37 to 15 00	12 50 to 13 25	11 75 to 12 00	10 75 to 11 50	13 50 to 14 00
14 to 14½	13 to 14	12½ to 13½	10¼	10 to 12½	9½ to 10	9
14 to 16	14 to 16	13½ to 14½	13½ to 14	13¾ to 15	16 to 17	13½
11¾ to 12	10 to 10¼	9¼	9 to 9½	8½	8½ to 8¾	8
15 00 to 16 00	15 00 to 16 00	....	....	7 50 to 8 50	....	....
....	....	7 00 to 8 50	7 00 to 8 50	....	7 00 to 8 50	7 00 to 8 50
18 to 20	18 to 20	18 to 21	19 to 21	27 to 29	25 to 30	32 to 37
10 to 17	10 to 17	10 to 17	10 to 16	21 to 25	14 to 25	8 to 30
13 to 14	....	....	8 to 9	9½ to 10½	12 to 13	10½ to 13½
3 to 9	....	....	4 to 7	2 to 6½	2 to 8½	4 to 10
4 00 to 6 00	4 00 to 6 00	4 00 to 6 00	4 75 to 6 50	5 25 to 8 00	6 50 to 8 00	5 00 to 8 00
6 00 to 11 00	6 00 to 11 00	6 00 to 11 00	6 00 to 12 00	11 00 to 13 00	8 50 to 13 00	8 50 to 13 00
13 00 to 18 00	13 00 to 18 00	13 00 to 18 00	13 00 to 20 00	18 00 to 20 00	14 00 to 20 00	14 00 to 20 00
27 to 35	27 to 34	27 to 33½	25 to 34	27 to 35	27 to 34	27 to 31
17 to 24	16 to 24	15 to 22½	21 to 24	22 to 24½	16 to 24½	16 to 24
4½ to 6	7 to 8	6 to 7	7 to 11	7 to 11	7 to 8	4½ to 5¾
7½ to 8	7½ to 8	6¾ to 7¼	7½ to 8¼	7½ to 8¼	7½ to 8¾	7 to 7½
8 to 8¾	7⅞ to 8⅜	7⅝ to 8⅝	7¾ to 8¼	8⅓ to 9⅓	$8\frac{13}{16}$ to 9¼	$8\frac{11}{16}$ to $9\frac{3}{16}$
9⅝ to 10⅝	9¼ to 10⅛	9 to 9⅞	9⅛ to 10	9½ to 10⅜	$9\frac{13}{16}$ to 10¼	9¾ to $10\frac{5}{16}$
2 25 to 2 35	2 15 to 2 20	2 10 to 2 20	1 85 to 1 95	1 95 to 2 05	1 85 to 1 95	1 80 to 1 90
2 35 to 2 45	2 20 to 2 30	2 30 to 2 40	2 15 to 2 25	2 25 to 2 30	2 15 to 2 25	2 20 to 2 30
1 00	1 00	94 to 94¾	....	90	93	....
98¼ to 98½	87⅜ to 88	86⅞ to 87¼	88½	85 to 85¾	83¼	83⅞
43⅓	37¼ to 38	37⅝ to 38	37⅞	39¼ to 39¾	37½	40½ to 42
48 to 49½	40 to 42½	40 to 41	46	42½ to 43¾	41½ to 43	46¼
....	....	....	....	....	....	....
40	....	18⅜ to 18¾	21 to 22	21⅝	22¾ to 23⅜	23½ to 24
50 to 1 00	30 to 60	25 to 40	30 to 40	35 to 45	35 to 48	25 to 40
4 50 to 7 00	4 50 to 6 50	4 00 to 5 50	4 00 to 6 25	4 00 to 7 50	4 00 to 8 00	8 00 to 9 00
19 50	16 50	15 00	13 00	13 00	12 00	12 00
24 00	22 00	20 00	18 00	18 00	17 00	17 00
13¼	13½	13½	14½	14	16	14
14¼	14	14	14½	13½	13½	12½
11½	....	9¼	9	8¾	8½	8
17 to 22	17 to 21	16 to 21	17 to 20	22 to 27	25 to 30	26 to 33
12 to 13	10 to 15	8 to 16	8 to 16	14 to 20	17 to 24	17 to 22
....	....	....	11½ to 12	11 to 11½	12 to 12½	11½ to 14
....	....	....	12 to 13	12 to 13½	13½ to 14	....
....	....	....	....	....	....	....
17 to 21	17 to 21	16 to 19	16 to 19	16 to 19	16 to 19	16 to 19
30 to 32	30 to 32	30	30	30	28 to 30	28 to 30

MARKET PRICES OF FARM

Product.	January.	February.	March.	April.	May.
NEW ORLEANS.					
Flour:					
Family .... bbl.	Nominal	$4 75 to $5 50	$5 37$\frac{1}{2}$ to $5 62$\frac{1}{2}$	$5 00 to $5 12$\frac{1}{2}$	$5 15 to $5 35
Minnesota patents.... do.	$7 00 to $7 50	6 87$\frac{1}{2}$ to 7 25	7 25 to 7 50	7 00 to 7 37$\frac{1}{2}$	7 00 to 7 50
Wheat:					
No. 2 red winter.... bush.	1 05 to 1 06	1 11 to 1 15	1 12 to 1 16	1 18	1 20
Corn, mixed .... do.	58	60 to 61	64 to 65	58	63
Oats .... do.	48	65 to 68	53 to 56	51$\frac{1}{2}$ to 52	54 to 55
Potatoes .... do.	2 50 to 3 00	2 75 to 3 00	2 75 to 3 00	3 00 to 3 25	2 50
Hay:					
Prime .... ton.	15 00 to 16 00	19 50	17 00 to 17 50	15 00 to 16 00	15 00 to 15 50
Choice .... do.	17 00 to 17 00	20 00 to 20 50	19 00 to 20 00	18 00	17 25 to 19 00
Beef:					
Western .... bbl.	....	12 00 to 14 00	12 00 to 13 00	12 00 to 14 50	12 50 to 14 00
Fulton market ...... $\frac{1}{2}$ bbl.	11 59 to 11 75	11 50 to 12 75	10 75 to 11 00	10 75 to 11 00	10 75 to 11 00
Pork:					
Mess .... bbl.	17 75	18 25 to 18 37	19 00 to 19 25	17 50	18 00 to 18 50
Bacon, (sugar cured, canvassed) .... lb.	13$\frac{3}{4}$ to 14	11$\frac{1}{2}$ to 12	12 to 12$\frac{1}{2}$	13 to 13$\frac{1}{2}$	13
Hams, (sugar cured, canvassed) .... lb.	13$\frac{1}{2}$ to 14$\frac{1}{2}$	11$\frac{1}{2}$ to 12$\frac{1}{2}$	13 to 14	12$\frac{1}{2}$ to 13	13$\frac{1}{2}$ to 14
Lard .... do.	11$\frac{1}{2}$ to 12	11$\frac{1}{4}$ to 11$\frac{3}{8}$	11$\frac{7}{8}$ to 12$\frac{3}{4}$	11$\frac{3}{8}$ to 12$\frac{1}{8}$	11$\frac{1}{2}$ to 12
Butter:					
Western creamery .... lb.	38 to 45	38 to 43	38 to 45	30 to 33	18 to 33
Western dairy .... do.	18 to 30	20 to 30	18 to 32	15 to 35	14 to 22
Cheese:					
New York cream ...... lb.	15	14 to 16	15	14	16
Western cream .... do.	13 to 14	12	12$\frac{1}{2}$ to 13	12	....
Sugar:					
Fair to fully fair ...... lb.	5$\frac{5}{8}$ to 5$\frac{7}{8}$	5$\frac{1}{2}$ to 5$\frac{7}{8}$	6$\frac{1}{4}$ to 6$\frac{5}{8}$	6$\frac{3}{4}$ to 7	6$\frac{7}{8}$ to 7
Prime to strictly prime .... lb.	6 to 6$\frac{1}{8}$	6 to 6$\frac{1}{8}$	6$\frac{3}{4}$ to 6$\frac{7}{8}$	7$\frac{1}{8}$	7$\frac{1}{4}$
Clarified .... do.	7 to 8	7 to 7$\frac{7}{8}$	8 to 8$\frac{1}{2}$	7$\frac{7}{8}$ to 8	7$\frac{7}{8}$ to 8$\frac{1}{8}$
Cotton:					
Low ordinary .... lb.	....	7$\frac{1}{4}$ to 7$\frac{1}{2}$	6$\frac{5}{8}$ to 6$\frac{7}{8}$	6$\frac{11}{16}$ to 6$\frac{13}{16}$	7$\frac{5}{16}$ to 7$\frac{7}{16}$
Ordinary to good ordinary .... lb.	8 to 8$\frac{15}{16}$	7$\frac{7}{8}$ to 8$\frac{3}{4}$	7$\frac{1}{4}$ to 8$\frac{7}{16}$	7$\frac{5}{16}$ to 8$\frac{5}{16}$	7$\frac{5}{16}$ to 8$\frac{15}{16}$
Low middling to good middling .... lb.	9$\frac{1}{4}$ to 10$\frac{1}{16}$	9$\frac{1}{8}$ to 10$\frac{7}{16}$	8$\frac{7}{8}$ to 10$\frac{5}{16}$	8$\frac{3}{4}$ to 10$\frac{1}{4}$	9$\frac{7}{16}$ to 10$\frac{1}{2}$
Middling fair .... do.	10$\frac{1}{2}$ to 10$\frac{11}{16}$	10$\frac{7}{8}$ to 11	10$\frac{11}{16}$ to 10$\frac{13}{16}$	10$\frac{1}{2}$ to 10$\frac{3}{4}$	10$\frac{13}{16}$ to 10$\frac{15}{16}$
Tobacco:					
Low to good lugs ...... lb.	....	....	5$\frac{3}{4}$ to 7	5 to 6	4$\frac{3}{4}$ to 5$\frac{1}{2}$
Low to medium leaf ... do.	....	....	7 to 8$\frac{3}{4}$	7 to 8$\frac{1}{2}$	5$\frac{3}{4}$ to 8
Good to fine .... do.	....	....	9 to 10$\frac{1}{2}$	9 to 9$\frac{1}{2}$	8$\frac{1}{2}$ to 9
Wool:					
Burry .... lb.	11 to 16	Nominal	Nominal	Nominal	10 to 11
Louisiana clear .... do.	22 to 23	....do.......	....do.......	....do.......	20 to 21
Clear lake .... do.	24 to 25	....do.......	....do.......	....do.......	21 to 22
Peanuts	5$\frac{1}{2}$ to 8	6 to 8	7 to 8	....do.......	7 to 9$\frac{1}{2}$
Rice:					
Common to good ...... lb.	4 to 5$\frac{3}{4}$	....	4$\frac{1}{2}$ to 6$\frac{1}{8}$	4$\frac{1}{2}$ to 6	4$\frac{5}{8}$ to 5$\frac{7}{8}$
Prime to choice .... do.	6 to 6$\frac{3}{8}$	6$\frac{1}{4}$	6$\frac{1}{4}$ to 6$\frac{3}{8}$	6 to 6$\frac{1}{8}$	6 to 6$\frac{1}{8}$
SAN FRANCISCO.					
Flour:					
Superfine .... bbl.	4 00 to 4 50	4 00 to 4 25	4 00 to 4 50	4 00 to 4 50	4 00 to 4 25
Extras .... do.	4 75 to 6 00	5 50 to 5 90	5 75 to 6 00	5 75 to 6 00	5 50 to 6 00
Wheat:					
No. 1 .... cental.	1 75 to 1 77$\frac{1}{2}$	1 85	1 92$\frac{1}{2}$	1 95 to 1 97$\frac{1}{2}$	1 80
No. 2 .... do.	1 70 to 1 72$\frac{1}{2}$	....	1 85 to 1 87$\frac{1}{2}$	1 90 to 1 92$\frac{1}{2}$	1 75
Barley .... do.	1 21	1 35	1 25 to 1 40	1 40 to 1 50	1 30 to 1 60
Corn:					
White .... do.	1 65 to 1 70	1 60	1 52 to 1 87	....	....
Yellow .... do.	1 47$\frac{1}{2}$ to 1 52$\frac{1}{2}$	....	....	1 67$\frac{1}{2}$ to 1 70	1 55 to 1 60
Oats .... do.	1 72$\frac{1}{2}$ to 1 90	1 75 to 1 97$\frac{1}{2}$	1 80 to 1 97$\frac{1}{2}$	1 80 to 2 10	1 85 to 2 20
Potatoes .... do.	50 to 1 25	80 to 1 30	75 to 1 20	50 to 1 10	60 to 1 25
Hay .... ton.	12 00 to 17 50	14 00 to 17 50	16 00 to 20 00	17 00 to 21 00	13 00 to 17 50
Pork:					
Mess .... bbl.	25 00 to 26 00	26 50	24 50 to 26 00	24 50 to 26 00	24 50 to 26 00
Bacon, breakfast ...... lb.	17 to 18	16$\frac{1}{2}$ to 16$\frac{3}{4}$	16$\frac{1}{2}$ to 16$\frac{3}{4}$	17$\frac{1}{2}$ to 18	16$\frac{1}{2}$ to 17
Hams .... do.	15 to 19	18$\frac{1}{2}$ to 19$\frac{1}{2}$	16 to 16$\frac{1}{2}$	16 to 16$\frac{1}{2}$	15 to 16
Lard (in tierces) .... do.	14 to 16	14$\frac{1}{2}$ to 16	14$\frac{3}{4}$ to 15$\frac{1}{2}$	15	14
Beef:					
Mess .... bbl.	16 00 to 16 50	16 00	16 00	16 00	16 00
Family mess .... do.	18 00 to 19 00	18 00 to 18 50	18 00 to 18 50	18 00 to 18 50	18 00 to 18 50
Butter:					
Fancy .... lb.	28 to 29	27	25 to 25$\frac{1}{2}$	25 to 26	25 to 26
California roll .... do.	24 to 27$\frac{1}{2}$	23 to 26	22$\frac{1}{2}$ to 24	21 to 24	21 to 24
Cheese:					
New York State factory .... lb.	18 to 20	18 to 20	18 to 20	18 to 20	18 to 20
California .... do.	14 to 16	14 to 16	14 to 16	13$\frac{1}{2}$ to 14$\frac{1}{2}$	12$\frac{1}{2}$ to 14

PRODUCTS FOR 1883—Continued.

June.	July.	August.	September.	October.	November.	December.
$5 25 to $5 50	$4 50 to $4 75	Nominal	$4 25	$4 25	$4 00	$4 40 to $4 63
7 25 to 7 50	7 00	$7 00	$7 00 to 7 25	7 50	7 50	7 00 to 7 25
1 25 to 1 27	1 15	1 15	1 12	$1 10 to 1 12	1 10	1 10 to 1 12
61	55	$0 55 to 56	56 to 56½	57	$0 55 to 56	55
52 to 53	43½ to 45	48 to 50	45 to 48	37 to 43	35 to 40	37 to 40
1 75 to 2 00	1 00 to 2 00	1 40 to 2 00	1 40 to 1 85	1 50 to 1 70	1 50 to 1 75	1 40 to 1 75
14 00 to 15 00	14 00 to 16 00	14 00 to 17 00	14 00 to 16 50	14 00 to 17 00	15 00 to 16 00	17 00
17 00 to 18 00	18 00 to 19 75	20 00	19 00 to 19 50	17 00	16 50 to 17 00	17 50
13 00 to 16 00	13 00 to 16 00	12 00 to 12 50	12 00 to 13 00	12 50 to 14 50	....	12 50 to 14 50
11 00	6 50 to 10 00	8 75 to 9 00	8 90 to 9 00	8 75 to 9 00	....	9 00
19 75 to 19 85	17 00 to 17 25	15 12½ to 15 25	14 00 to 14 50	11 50 to 12 00	11 50 to 12 00	13 25 to 13 75
13¼	13¼	12½	12	12	11½	10¼ to 11
13¾ to 14	13 to 13¼	13½ to 14½	12 to 15	10 to 16	10 to 17	15 to 16
11⅜ to 12	9¾ to 10¼	9½ to 10	....	8⅜ to 9¼	8 to 8⅝	7¼ to 9
18 to 23	20 to 25	16 to 23	18 to 29	25 to 33	26 to 33	25 to 43
15 to 19	15 to 18	15 to 18	16 to 19	18 to 24	20 to 25	20 to 33
....	16	13	13 to 13¼	13 to 13½	13½	14½ to 15
13	12½	9 to 9½	10 to 10¼	10 to 10½	10 to 11	11
6⅞ to 7¼	7¼ to 7½	7¼ to 7¾	7¼ to 7½	7½ to 7¾	5⅝ to 6¼	5¼ to 5⅞
7⅜	7⅝	7⅛	7¼	7⅛	6½	6 to 6¼
8 to 8⅜	8 to 8⅛	8¼	8 to 8⅛	8⅛ to 8⅜	6¾ to 7⅞	6⅛ to 7½
7½ to 7⅝	7 3/16 to 7 5/16	7 1/16 to 7 3/16	....	....	....	....
8⅛ to 9⅛	7 13/16 to 8 13/16	7 11/16 to 8 11/16	7⅞ to 9⅛	8¼ to 9⅜	8¾ to 9¾	8 11/16 to 9 11/16
9⅝ to 10⅝	9¼ to 10¼	9 1/16 to 9 5/16	9½ to 10¼	9⅝ to 10 7/16	10⅛ to 10 11/16	9⅞ to 10½
10 11/16 to 11⅞	10 5/16 to 10½	10 1/16 to 10¼	10⅜ to 10½	10 9/16 to 10 11/16	10 11/16 to 10 13/16	10⅝ to 10¾
4¾ to 5½	5¼ to 6¼	5¼ to 6¼	5¼ to 6½	5¼ to 6½	5¼ to 6½	6½ to 7½
5¾ to 8	6¼ to 8¾	8¼ to 8¾	6¼ to 7½	6¼ to 7	6¼ to 8¾	7½ to 9
8½ to 9	9 to 10½	9 to 10½	9 to 11	9 to 11	9 to 11	8½ to 9½
10 to 12	10 to 11	9 to 11	9 to 12	9 to 12	9 to 15	9 to 14
21 to 22	21	20 to 21½	20 to 21	19 to 21	19 to 20	19 to 20
23 to 23½	23½	22 to 23	21 to 23	21 to 22	22	21 to 22
7¾ to 10	7½ to 10½	7½ to 10½	8 to 11	10 to 12	10 to 12	10 to 12
4¾ to 5¾	4 to 6	4 to 5¾	3¾ to 5	3½ to 5½	4 to 5½	3⅞ to 5⅝
5⅞ to 6⅛	6 to 6¼	6⅛	6 to 6⅞	5⅞	5¾ to 6	5¾ to 6¾
3 75 to 4 00	3 50 to 3 75	3 50 to 3 75	4 00 to 4 25	3 75 to 4 25	3 75 to 4 50	4 00 to 4 50
5 25 to 5 75	5 00 to 5 50	5 00 to 5 50	5 25 to 5 50	5 00 to 5 25	5 00 to 5 25	5 00 to 5 75
1 62½ to 1 65	1 60 to 1 62½	1 61 to 1 62	1 67½ to 1 70	1 67½ to 1 70	1 68¾ to 1 71	....
1 57½ to 1 60	....	....	....	....	1 65 to 1 67½	....
95 to 1 05	95	92½ to 1 00	1 00 to 1 12½	90 to 1 50	1 05 to 1 50	1 02 to 1 37½
....	1 57½ to 1 60	....	....	....	1 50	1 45 to 1 50
1 55 to 1 60	1 60 to 1 62½	1 50 to 1 65	....	....	....	....
1 95 to 2 15	1 80 to 2 20	1 39 to 1 60	....	....	1 25 to 1 60	1 45 to 1 85
25 to 80	60 to 85	80 to 90	80 to 90	65 to 90	40 to 90	45 to 90
13 00 to 18 00	7 00 to 14 00	6 00 to 13 00	9 00 to 13 00	9 00 to 13 00	9 00 to 14 50	9 00 to 13 50
24 50 to 26 00	24 50 to 25 00	24 50 to 25 00	24 50 to 25 00	24 50 to 25 00	24 50 to 25 00	24 50 to 25 00
16½ to 17	16 to 16½	15½ to 16	15½ to 16	15½ to 16	15½ to 16	15½ to 16
15 to 16	15 to 16¼	16 to 17	16 to 17	16 to 17	16 to 17	14 to 16
14	15	15	15	15	15	15
16 00	15 00 to 15 50	15 00 to 15 50	15 00 to 15 50	15 50	15 50	15 50
18 00 to 18 50	18 00 to 18 50	18 00 to 18 50	18 50	18 50	18 50	18 00 to 18 50
23	24	27½	32½ to 35	47½ to 50	40 to 46	42½
19 to 22	19 to 23	17 to 26	22½ to 32	22½ to 42½	22½ to 37	22½ to 40
....	....	17 to 18	17 to 18	17 to 18	17 to 18	17 to 18
10 to 12	**9 to 11**	**9 to 16**	**10 to 16**	**14 to 17**	**12 to 17**	**15 to 17**

MARKET PRICES OF FARM

Product.	January.	February.	March.	April.	May.
SAN FRANCISCO—Cont'd.					
Wool:					
Choice fall ....lb.	....	$0 17 to $0 18	$0 18 to $0 20	....	....
Free mountain ....do.	....	15 to 16	16 to 17	....	....
Fair mountain ....do.	....	13	13 to 14	....	....
Eastern Oregon ....do.	....	....	....	....	....
San Joaquin and middle county ....lb.	....	....	....	....	....

LIVE-STOCK

Product.	January.	February.	March.	April.	May.
BALTIMORE.					
Cattle:					
Best beeves ....cental.	$5 25 to $6 25	$5 75 to $6 40	$6 25 to $6 50	$6 37 to $7 00	$6 25 to $7 12
First quality ....do..	4 25 to 5 25	4 50 to 5 62	4 50 to 4 75	5 50 to 6 25	5 87 to 6 00
Medium ....do..	3 50 to 4 25	3 87 to 4 37	4 25 to 4 50	4 37 to 5 01	4 25 to 5 25
Milch cows ....head.	45 00 to 50 00	....	....	....	....
Swine (net) ....cental.	8 50 to 8 75	8 00 to 9 25	9 00 to 10 25	9 75 to 11 00	9 75 to 10 75
Sheep ....do..	3 50 to 5 75	3 50 to 5 88	4 50 to 6 50	4 50 to 6 75	4 00 to 5 75
SAINT LOUIS.					
Cattle:					
Export steers .....cental.	....	5 50 to 5 85	6 00 to 6 30	6 30 to 6 50	6 00 to 6 15
Good to heavy steers..do..	5 25 to 5 75	5 00 to 5 40	5 60 to 6 00	5 75 to 6 00	5 75 to 5 85
Fair to good ....do..	4 50 to 5 50	4 40 to 5 00	4 80 to 5 45	4 90 to 5 75	5 25 to 5 60
Milch cows (with calves), head	25 00 to 60 00	25 00 to 60 00	25 00 to 60 00	24 00 to 60 00	21 00 to 50 00
Sheep:					
Good to choice muttons, cental	3 50 to 4 25	4 75 to 2 25	4 75 to 5 40	4 75 to 5 45	4 65 to 5 10
Medium to fair muttons, cental	3 00 to 3 40	4 00 to 4 60	3 75 to 4 50	3 75 to 4 50	3 50 to 4 60
Swine, common to good packing ....cental.	5 90 to 6 20	6 20 to 6 40	6 75 to 7 15	6 75 to 7 10	6 75 to 7 10
Horses:					
Streeters ....head.	90 00 to 125 00	....	....	....	....
Draft ....do..	125 00 to 200 00	....	....	....	....
Saddlers ....do..	90 00 to 160 00	....	....	....	....
Mules:					
14 hands ....head.	90 00 to 105 00	....	....	....	....
14½ hands ....do..	105 00 to 115 00	....	....	....	....
15 hands ....do..	120 00 to 130 00	....	....	....	....
16 to 16½ hands, extra.do..	185 00 to 200 00	....	....	....	....
KANSAS CITY.					
Cattle:					
Native cows ....cental.	3 10 to 4 35	3 00 to 3 85	2 75 to 4 00	2 75 to 6 00	3 40 to 4 65
Native steers ....do..	4 50	3 90 to 4 60	4 00 to 4 50	5 16 to 5 62½	5 25 to 5 50
Native shippers.......do..	5 20	4 40 to 5 37	3 85 to 5 60	5 90 to 6 50	5 65 to 6 90
Swine...................do..	5 25 to 6 25	6 25 to 6 60	5 60 to 7 30	6 85 to 7 65	6 75 to 7 27½
Sheep	2 00 to 3 20	2 15	2 25 to 4 75	5 10	2 50 to 4 65
CHICAGO.					
Cattle:					
Extra beeves.......cental.	6 25 to 6 50	6 25 to 6 50	6 25 to 6 50	7 00 to 7 35	6 75 to 7 20
Choice beeves.........do..	5 80 to 6 10	5 75 to 6 05	5 75 to 6 00	6 75 to 6 90	6 50 to 6 70
Good beeves ....do..	5 40 to 5 70	5 35 to 5 70	5 35 to 5 65	6 35 to 6 65	6 00 to 6 20
Medium beeves ....do..	4 40 to 5 00	4 50 to 5 15	4 90 to 5 15	5 85 to 6 15	5 70 to 6 00
Veals ....do..	4 50 to 7 50	4 50 to 4 75	4 50 to 7 50	4 50 to 7 50	4 00 to 6 90
Sheep ....do..	2 75 to 5 00	4 00 to 5 75	3 25 to 6 12½	4 00 to 7 00	4 25 to 6 00
Swine	5 65 to 6 65	6 10 to 7 15	6 15 to 7 25	7 30 to 8 10	7 10 to 7 75
NEW ORLEANS.					
Cattle:					
Texan, good to smooth fat cattle.........cental.	4 00 to 5 50	4 00 to 5 50	4 00 to 6 00	5 50 to 6 50	5 50 to 7 00
Grass-fed ....head.	16 00 to 30 00	14 00 to 28 00	15 00 to 30 00	15 00 to 30 00	18 00 to 35 00
Milch cows ....do..	25 00 to 100 00	25 00 to 100 00	25 00 to 100 00	25 00 to 100 00	25 00 to 100 00
Calves ....do..	6 00 to 11 00	6 00 to 10 00	6 00 to 10 00	6 00 to 10 00	7 00 to 10 00
Sheep ....head.	1 50 to 3 00	1 75 to 3 00	1 50 to 4 00	1 50 to 4 00	1 50 to 4 00
Swine ....cental.	5 00 to 6 50	5 00 to 6 50	5 00 to 7 50	5 00 to 7 50	5 00 to 8 50
Horses:					
Common ....head.	60 00 to 80 00	60 00 to 85 00	60 00 to 80 00	60 00 to 80 00	60 00 to 80 00
Good work ....do..	80 00 to 175 00	80 00 to 175 00	80 00 to 175 00	80 00 to 175 00	80 00 to 175 00
Saddle and harness ..do..	175 00 to 250 00	175 00 to 250 00	175 00 to 250 00	175 00 to 250 00	175 00 to 250 00
Mules:					
Good medium ....head.	125 00 to 135 00	125 00 to 135 00	125 00 to 135 00	125 00 to 135 00	125 00 to 135 00
Rice ....do..	135 00 to 155 00	135 00 to 155 00	135 00 to 155 00	135 00 to 155 00	135 00 to 155 00
First class ....do..	155 00 to 185 00	155 00 to 185 00	155 00 to 185 00	155 00 to 185 00	155 00 to 185 00
Extra heavy ....do..	185 00 to 225 00	185 00 to 225 00	185 00 to 225 00	185 00 to 225 00	185 00 to 225 00

PRODUCTS FOR 1883—Continued.

June.	July.	August.	September.	October.	November.	December.
......	......	......				......
......	......	......	$0 22 to $0 24	$0 24 to $0 24	$0 22 to $0 24	......
......	......	......	......	......	......	......
$0 18 to $0 20	$0 20 to $0 22	$0 20 to $0 22	20 to 22	20 to 22	22 to 22	$0 17 to $0 22
14 to 20	16 to 19	16 to 19	16 to 19	16 to 19	16 to 19	16 to 19

MARKETS.

$6 75 to $7 00	$6 50 to $6 75	$5 75 to $6 00	$5 50 to $6 06	$5 00 to $5 87	$5 75 to $6 00	$5 62 to $6 00
5 50 to 6 00	5 25 to 6 25	4 62 to 5 62	4 50 to 5 50	3 75 to 4 87	4 50 to 5 50	4 25 to 5 25
4 25 to 5 25	4 62 to 5 12	3 87 to 4 50	3 75 to 4 37	3 25 to 3 62	3 87 to 4 25	3 00 to 4 00
......	......	......	......	......	50 00 to 55 00	60 00 to 65 00
9 25 to 10 25	8 25 to 9 00	8 00 to 8 75	7 00 to 8 25	6 00 to 6 37½	7 00 to 7 25	5 50 to 6 50
3 50 to 5 75	2 25 to 5 50	3 00 to 5 25	2 00 to 5 00	3 00 to 4 75	3 25 to 5 00	3 00 to 4 62½
5 90 to 6 15	5 90 to 6 00	5 85 to 6 00	5 90 to 6 15	5 80 to 6 15	6 10 to 6 40	6 10 to 6 40
5 65 to 5 85	5 50 to 5 75	5 35 to 5 75	5 50 to 5 75	5 50 to 5 75	5 60 to 6 00	5 60 to 6 00
5 20 to 5 50	5 00 to 5 25	4 85 to 5 10	4 00 to 4 75	4 00 to 4 75	4 25 to 5 25	4 00 to 5 40
20 00 to 45 00	18 00 to 45 00	17 00 to 45 00	17 00 to 40 00	17 00 to 38 00	20 00 to 50 00	25 00 to 50 00
4 60 to 5 00	4 50 to 4 75	4 10 to 4 50	3 90 to 4 56	3 90 to 4 15	3 50 to 4 00	3 25 to 4 00
3 50 to 4 50	3 40 to 4 50	3 60 to 4 00	3 00 to 3 35	3 00 to 3 25	3 00 to 3 25	2 00 to 3 25
6 70 to 7 00	6 50 to 6 80	5 90 to 6 05	4 50 to 4 80	4 60 to 4 90	4 20 to 4 50	4 75 to 5 10
......	......	110 00 to 135 00	110 00 to 135 00	110 00 to 135 00	110 00 to 135 00	110 00 to 140 00
......	......	150 00 to 210 00	150 00 to 210 00	150 00 to 225 00	150 00 to 225 00	150 00 to 225 00
......	......	125 00 to 200 00	125 00 to 200 00	125 00 to 200 00	125 00 to 200 00	110 00 to 175 00
......	......	100 00 to 125 00	90 00 to 115 00	90 00 to 115 00	90 00 to 115 00	75 00 to $90 00
......	......	110 00 to 135 00	115 00 to 135 00	115 00 to 135 00	115 00 to 135 00	110 00 to 130 00
......	......	120 00 to 150 00	140 00 to 165 00	140 00 to 165 00	140 00 to 165 00	130 00 to 150 00
......	......	160 00 to 210 00	175 00 to 210 00	175 00 to 210 00	175 00 to 210 00	170 00 to 205 00
3 25 to $4 20	3 00 to 4 00	3 00 to 3 65	2 50 to 3 25	2 20 to 3 25	2 20 to 3 40	3 50 to 3 70
4 65 to 5 05	4 40 to 4 65	4 20 to 4 62½	3 05 to 3 70	4 20 to 4 62½	......	......
5 35 to 5 70	5 00 to 5 60	4 50 to 5 00	4 75 to 5 85	5 10 to 5 35	4 85 to 5 05	5 70
6 25 to 7 00	5 75 to 6 50	5 40 to 5 60	5 15 to 5 20	4 55 to 4 65	4 25 to 4 37½	......
2 50 to 4 40	2 75 to 4 00	3 50 to 3 90	2 35 to 3 50	1 00 to 2 50	3 65 to 3 90	3 00
6 20 to 6 35	6 20 to 6 35	6 20 to 6 30	6 25 to 6 40	6 40 to 6 50	6 75 to 7 00	6 50 to 6 55
6 00 to 6 10	6 00 to 6 10	5 90 to 6 10	5 90 to 6 15	6 00 to 6 25	6 25 to 6 60	6 00 to 6 40
5 75 to 5 90	5 70 to 5 80	5 50 to 5 80	5 50 to 5 75	5 50 to 5 75	5 50 to 6 00	5 25 to 5 75
5 50 to 5 70	5 00 to 5 70	4 75 to 5 76	4 50 to 5 25	4 40 to 5 25	4 25 to 5 25	4 25 to 5 20
3 75 to 5 25	3 75 to 5 50	4 00 to 7 50	3 50 to 7 25	3 75 to 7 25	3 75 to 7 25	3 00 to 7 25
2 90 to 5 37½	2 50 to 4 75	2 50 to 4 75	3 00 to 4 75	2 25 to 4 00	2 00 to 4 50	2 80 to 4 00
6 65 to 7 40	5 60 to 6 15	5 00 to 6 00	4 75 to 6 00	4 50 to 5 15	4 60 to 5 25	4 40 to 5 35
4 00 to 5 50	4 00 to 6 00	4 00 to 5 00	4 00 to 4 75	3 50 to 4 50	3 50 to 4 75	3 50 to 4 75
18 00 to 30 00	10 00 to 23 00	16 00 to 25 00	16 00 to 22 00	15 00 to 30 00	16 00 to 35 00	16 00 to 32 00
25 00 to 100 00	25 00 to 100 00	25 00 to 100 00	25 00 to 100 00	25 00 to 100 00	25 00 to 100 00	25 00 to 100 00
6 00 to 10 00	7 00 to 10 00	5 00 to 10 00	5 00 to 9 00	5 00 to 9 00	6 00 to 10 00	5 00 to 9 00
1 50 to 4 00	1 50 to 4 00	1 50 to 3 50	1 50 to 3 75	1 50 to 5 00	1 50 to 3 50	1 50 to 3 50
5 00 to 8 00	5 00 to 7 50	5 00 to 7 50	5 00 to 7 50	4 50 to 6 50	4 50 to 6 00	4 00 to 6 00
60 00 to 80 00	60 00 to 80 00	60 00 to 80 00	60 00 to 80 00	60 00 to 80 00	60 00 to 85 00	60 00 to 85 00
80 00 to 175 00	80 00 to 175 00	80 00 to 175 00	80 00 to 175 00	80 00 to 185 00	80 00 to 175 00	80 00 to 175 00
175 00 to 250 00	175 00 to 250 00	175 00 to 250 00	175 00 to 250 00	175 00 to 200 00	175 00 to 200 00	175 00 to 200 00
125 00 to 135 00	125 00 to 135 00	125 00 to 135 00	125 00 to 135 00	125 00 to 135 00	125 00 to 135 00	125 00 to 135 00
135 00 to 155 00	135 00 to 155 00	135 00 to 155 00	135 00 to 155 00	135 00 to 155 00	135 00 to 155 00	135 00 to 155 00
155 00 to 185 00	155 00 to 185 00	155 00 to 185 00	155 00 to 185 00	155 00 to 185 00	155 00 to 185 00	155 00 to 185 00
185 00 to 225 00	185 00 to 225 00	185 00 to 225 00	185 00 to 225 00	185 00 to 225 00	185 00 to 225 00	185 00 to 225 00

LIVE-STOCK

Product.	January.	February.	March.	April.	May.
BOSTON.					
Cattle:					
Fair to good country (dressed)........cental.	$6 87½ to $8 00	$6 90 to $8 10	$6 87½ to $8 00	....	$6 37½ to $8 00
Premium bullocks...do..	....	....	....	....	9 25
Milch cows........head..	40 00 to 80 00	40 00 to 80 00	40 00 to 80 00	$40 00 to $80 00	20 00 to 80 00
Veal calves............lb.	3 to 7½	3½ to 7	3 to 7½	3½ to 6	5 to 6
Sheep.....................do.	4¾ to 6½	4½ to 6	4¾ to 6½	4 to 6	3 to 7½
Swine.....................do.	6¾ to 7¾	6½ to 7	6¾ to 7¾	8 to 8½	7½ to 8¼
CINCINNATI.					
Cattle:					
Choice to extra shipping steers (gross) ...cental.	5 75 to 6 50	5 75 to 6 25	5 75 to 6 00	5 75 to 6 00	6 25 to 6 40
Fair to good shipping steers...........cental.	4 75 to 5 50	4 75 to 5 50	5 00 to 5 50	5 25 to 5 75	5 50 to 6 00
Good to choice butchers' grades ....cental.	4 75 to 5 00	4 75 to 5 25	5 00 to 5 60	5 50 to 6 00	6 00 to 6 25
Fair to medium butchers' grades ....cental.	3 75 to 4 50	3 75 to 4 50	4 00 to 4 75	4 25 to 5 25	4 50 to 5 75
Good to extra fat cows and heifers......cental.	4 00 to 4 75	4 25 to 5 00	4 50 to 5 40	4 75 to 5 75	5 25 to 6 00
Sheep.....................do.	2 50 to 5 25	2 75 to 5 50	3 50 to 6 00	3 75 to 6 00	3 50 to 5 75
Swine.....................do.	5 25 to 6 50	5 50 to 6 80	6 00 to 7 50	6 25 to 7 95	6 20 to 7 80
PHILADELPHIA.					
Cattle:					
Common to choice beeves, cental...................	4 25 to 7 25	4 75 to 7 00	5 25 to 7 25	5 75 to 7 87½	6 38 to 7 38
Milch cows..........head.	40 00 to 80 00	30 00 to 70 00	30 00 to 70 00	30 00 to 70 00	30 00 to 75 00
Sheep................cental.	3 00 to 6 00	4 00 to 6 62	4 00 to 7 00	4 50 to 7 25	4 00 to 7 25
Swine....................do..	8 00 to 9 50	8 25 to 10 00	8 50 to 10 50	10 25 to 11 50	10 50 to 11 50
NEW YORK.					
Cattle:					
Best beeves........cental.	10 00 to 11 00	10 00 to 11 50	11 00 to 12 25	12 75 to 13 75	12 50 to 13 00
Common to good.....do..	9 00 to 10 00	9 50 to 10 00	10 00 to 10 50	11 00 to 11 75	10 50 to 11 25
Milch cows..........head.	35 00	35 00	35 00 to 50 00	40 00 to 60 00	35 00 to 65 00
Veal calves ....cental.	3 75 to 4 25	4 00 to 4 50	4 40 to 5 20	4 50 to 6 00	5 00 to 7 00
Sheep.....................do.	4 25 to 6 25	4 50 to 6 70	5 00 to 7 10	5 20 to 7 25	5 75 to 7 25
Swine.....................do	6 25 to 6 50	6 50 to 7 75	7 00 to 8 00	7 80 to 8 35	8 00 to 8 25

MARKETS—Continued.

June.	July.	August.	September.	October.	November.	December.
$6 37 to $8 00	$6 75 to $7 75	$6 75 to $7 90	$6 75 to $8 75	$5 50 to $6 00	$4 75 to $6 75	....
9 00	....	6 75	5 75 to 6 75	6 75 to 8 00	7 00	....
20 00 to 80 00	35 00 to 50 00	20 00 to 60 00	25 00 to 75 00	25 00 to 80 00	30 00 to 75 00	$40 00 to $55 00
5 to 6½	3 to 6¾	3 to 6¼	3¼ to 7	3¼ to 7½	3¼ to 7½	3½ to 7½
3½ to 7	3 to 6¼	2½ to 5½	3 to 6¼	....	2¾ to 5¼	3½ to 5¼
7½ to 8¾	6½ to 7	5¾ to 6½	5⅝ to 6¼	5¼ to 5¾	5¼ to 5¾	5¼ to 5¾
6 00 to 6 25	5 50 to 5 75	5 40 to 6 00	5 25 to 5 80	5 25 to 5 75	5 00 to 5 60	5 50 to 5 90
5 50 to 5 75	4 75 to 5 25	4 50 to 5 25	4 25 to 5 00	4 25 to 5 00	4 25 to 4 75	4 50 to 5 25
4 85 to 6 10	5 25 to 5 60	4 50 to 5 25	4 25 to 4 75	4 25 to 4 75	4 25 to 4 65	4 50 to 4 85
4 25 to 4 60	4 00 to 5 00	3 25 to 4 25	3 00 to 4 00	3 25 to 4 00	3 00 to 4 00	3 25 to 4 25
5 25 to 5 85	5 00 to 5 25	4 60 to 5 10	4 50 to 4 90	4 25 to 4 60	3 75 to 4 50	4 25 to 4 75
3 00 to 5 50	2 50 to 5 00	2 25 to 5 00	2 50 to 5 00	2 00 to 4 25	2 00 to 4 50	2 75 to 4 50
5 75 to 7 30	6 00 to 6 60	4 40 to 6 25	4 75 to 5 75	4 50 to 5 30	4 40 to 6 25	4 00 to 5 50
5 75 to 7 25	5 50 to 6 75	5 25 to 6 75	5 25 to 6 75	4 00 to 6 50	4 00 to 6 50	4 25 to 6 50
35 to to 65 00	35 00 to 75 00	35 00 to 75 00	35 00 to 75 00	30 00 to 90 00	30 00 to 75 00	30 00 to 75 00
3 00 to 6 25	2 75 to 6 00	4 50 to 5 75	4 50 to 5 75	2 75 to 4 75	2 50 to 5 00	2 25 to 5 00
10 00 to 10 75	8 00 to 9 50	8 50 to 9 00	8 00 to 8 75	7 00 to 7 50	6 50 to 7 25	6 75 to 7 50
12 25 to 12 75	11 50 to 11 75	11 25 to 11 75	11 00 to 11 75	11 00 to 11 50	11 50 to 12 00	11 25 to 11 75
10 50 to 11 00	10 25 to 11 00	10 25 to 10 75	9 75 to 10 50	8 75 to 10 25	8 75 to 10 50	9 25 to 11 00
35 00 to 60 00	40 00 to 65 00	30 00 to 60 00	30 00 to 65 00	35 00 to 65 00	35 00 to 60 00	35 00 to 65 00
5 00 to 7 50	6 50 to 8 00	6 00 to 8 50	6 00 to 8 00	6 00 to 9 25	6 00 to 9 31	7 00 to 10 00
5 00 to 7 00	4 00 to 6 25	4 50 to 6 25	4 00 to 6 00	3 75 to 5 25	3 75 to 5 40	4 50 to 5 50
7 50	7 00	6 25 to 6 75	6 00 to 6 50	5 50 to 6 10	5 50 to 6 10	4 25 to 4 50

EUROPEAN STATISTICS.

In the annual report for 1876 was published an elaborate translation and rendering in equivalent measures of surface and capacity of the essential features of the report of the International Congress on the Agricultural Statistics of Europe. Fragmentary publications of official statistics have been repeatedly presented since in annual and special reports. During the past year our agent in London, Mr. Edmund J. Moffat, has furnished several contributions to the literature of official and commercial statistics of European agriculture.

The investigations of foreign Governments are so irregular in point of time and method, the publications of some so infrequent, the absence of important enumerations so conspicuous as to many of these countries, that much is left to commercial guessing and manipulation for effect on the market. Numerous inquiries have been made of late for a more comprehensive and uniform presentation of the most authentic statement bearing on production, and especially upon the wheat product. An effort has therefore been made to co-ordinate the facts of production as to breadstuffs, to grain and potatoes, the result of which is presented in the following pages.

Owing to the importance of wheat as an American export, a comprehensive view of its production in Europe is presented in Table I, showing the total wheat product of each country in Europe, except the little state of Montenegro, which has a population of only about a quarter of a million. It is not possible to obtain absolutely synchronous official statistics for all the countries embraced in the table, but the figures at the foot of column B may be regarded as an approximation to the average wheat product of Europe for a period of several years ending with 1873, while those at the foot of column D may be regarded as the approximate average for a similar period ending with the year 1881. The figures in the former column are the result of an inquiry suggested by the International Statistical Congress which met at St. Petersburg in 1872, and confided by that body to the statistical corps of the French Government, who made their report to the International Congress at its next succeeding session. In nine cases out of twenty their figures represented, as shown in column A, the production of an average year. The figures for Ireland and for all but two of the States comprehended under the name "Germany" were for 1873, the two States excepted being Prussia and Bavaria, for which the figures reported were for 1867 and 1863, respectively. For a number of the smaller German States no returns were obtained by the statisticians of the International Congress, and the figures for Germany given in column B would therefore be somewhat augmented if returns for the States not heard from were included. For Sweden, Austria, and Russia, the figures in column B are, respectively, for 1872, 1871, and 1870; those for Servia, Switzerland, and Turkey are for 1868, and those for Greece are for 1867. In connection with the figures for Italy, in the same column, no date is given, while those for Spain are for the year 1857. It will be seen that the figures reported by the statisticians of the International Congress represent usually the production of an average year or the production of some one year within the period 1867–'73, inclusive.

The figures in column D, as will be seen by the explanations in column C, are in twelve cases out of twenty an expression of the average production of the countries to which they relate for certain specified periods. In eight cases the period for which the average production is

given embraces the eight years from 1874 to 1881, inclusive. This is the period given for Austria, Hungary, France, Great Britain, Ireland, Italy, the Netherlands, and Sweden. As to Russia no recent returns are available; the returns given for that country embrace the years 1874–'80. In Germany, crop statistics for the whole empire, compiled upon a uniform plan by the Imperial Government, were not published until 1878, and accordingly the period given for Germany in column D embraces only the four years 1878–'81. For Denmark and Roumania the periods given are respectively 1875–'81 and 1876–'81.

For countries named in the preceding paragraph except Great Britain, Italy, and Roumania, statistics have been obtained from official publications of the several countries to which they relate, the foreign units of measure or weight being, of course, reduced to their American equivalents. For Italy and Roumania yearly statistics are not available, but the average given for the former country is based upon an official statement of the average for 1875–'80 combined with official returns for the years 1874 and 1881, while the average given for Roumania is an official estimate. The average for Roumania, in column D, and the figures from which are derived the averages, in the same column, for Russia and Great Britain, were furnished to the State Department by our consuls-general in those countries, while the figures forming the basis for the average for Denmark were furnished to the same Department by Consul Ryder, of Copenhagen. The figures for Great Britain are from unofficial sources, no official statistics as to the yield of the different crops being kept for Great Britain, although the acreage under each crop is published annually, while for Ireland both acreage and product are regularly stated.

For the Netherlands the statistics for the years 1874–'80 are from the *Résumé Statistique des Pays-Bas* for 1850–'81, a report prepared from official data and under official auspices by the Statistical Society of the Netherlands, while those for 1881 are taken from the *Verslag over den Landbouw* (or report on agriculture), prepared in 1881 under the direction of the minister of water inspection, commerce, and industry.

There remain eight countries for which an average for any specific number of years cannot be given. These are Belgium, Greece, Portugal, Servia, Spain, Norway, Switzerland, and Turkey. The figures given for Belgium in column D are taken from a statement on the average wheat product of the principal European countries made to the Department of State by Consul-General Edgar Stanton, of St. Petersburg, and published in United States Consular Reports, No. 34 (October, 1883). They do not differ very widely from those given for the same country in 1873 by the statisticians of the International Congress, and they lie between the extremes of the different commercial estimates on the same subject.

The average given for Portugal in the same column is an approximation based upon an estimate recently given to Consul-General Francis, of Lisbon, by the chief of the agricultural division of the Portuguese Department of Public Works. The estimated annual value of the wheat product of Portugal, according to this officer, averages $13,365,000, and tested by the average gazette prices of wheat in London for the ten years 1872–'81 (about $1.52 per imperial bushel), this would represent 8,792,763 imperial bushels, or 9,069,911 Winchester bushels. The average given by Mr. Stanton in the statement above referred to is 8,934,000 bushels, while commercial estimates are at hand varying from 8,232,000 to 10,085,152 bushels. The round number adopted (9,000,000 bushels) lies between these extremes, varies but little from the figures given by

Consul-General Stanton in the statement above referred to, and bears a reasonable relation to the official estimate of the average *value* of the Portuguese wheat crop as stated to Consul-General Francis and published on page 459 of United States Consular Reports, No. 33 (September, 1883).

The average given for Servia is the equivalent in Winchester bushels of 1,500,000 hectoliters, at which the average wheat crop of that country was broadly stated in one of the recent communications of Mr. E. J. Moffat, statistical agent of the Department at London.

In the communication just referred to, which was published in the report of the Department for September, 1883, the average wheat crop of Spain is placed at 42,000,000 hectoliters, or 119,188,440 bushels, the quantity given in column D, Table I.

In the absence of any average for Norway, the official figures showing the wheat product of that country for the year 1875 are placed in column D, Table I, as an approximate average.

For Greece, Switzerland, and Turkey no figures could be obtained of later date than those given in the report to the International Congress, and accordingly the latter are used in column D as well as in column B. With reference to the figures in column D the countries embraced in Table I may be arranged in the following classes:

I. Those whose average product is given for certain specific periods ending with the year 1881, except in the case of Russia, whose average is for a period ending with 1880.

II. Those whose average product is stated in a less definite way, no term of years being given to which the alleged average is assigned.

III. Those for which no statement of average annual product is given, the product of some one year being given as the nearest attainable approximation to such average.

The countries of Class I are twelve in number and embrace all the heavy wheat-producing countries of Europe except Spain. Classes II and III embrace four countries each, or eight in all, of which five are insignificant as producers of wheat, their aggregate product being less than 21,000,000 bushels. The relative importance of the three classes will, however, be made more apparent by the following statement as to the amounts which they respectively contribute to the total at the foot of column D:

	Bushels.
The countries of Class I contribute	938,132,579
The countries of Class II contribute	157,293,107
The countries of Class III contribute	48,400,358
Total	1,143,826,044

With these figures before us, it is found by a simple computation in percentage that more than four-fifths of the total at the foot of column D, Table I, consist of averages for specific periods, while the countries of Class III for which the product of single years has to be given in lieu of an average contribute but a fraction more than 4 per cent. of the same total. On the whole this total may fairly be considered as a tolerably close approximation to the average annual wheat product of Europe for the period 1874–'81.

The figures reported to the International Statistical Congress and presented in column B, Table I, are much less nearly uniform as regards the time to which they relate, but, as above stated, they are in general either for an average year or for some single year within the period 1867–'73. The exceptions are those for Spain and Bavaria, the latter being included in the figures for Germany. If for the purposes

of comparison it be assumed that for this period, 1867–'73, the figures in column B are a rough approximation to an average annual product, we shall have the following comparative statement as to the average annual wheat product of Europe for the two periods more or less accurately represented by columns B and D, respectively:

	Bushels.
Eight years 1867–'73	1,183,032,763
Eight years 1874–'81	1,143,826,044
Decrease	39,206,719

Of the figures for 1882 in Table I, those for Austria-Hungary, Belgium, France, Germany, Italy, and Sweden are official. Those for Great Britain and Ireland are the estimates of Maj. P. G. Craigie, Secretary of the Central Chamber of Agriculture of Great Britain. Those for Spain are given on the authority of Mr. Foster, United States Minister at Madrid, by whom they were communicated to our London agent. This leaves Denmark, Greece, Holland, Portugal, Roumania, Russia, Servia, Norway, Switzerland, and Turkey—all except Russia comparatively unimportant in the extent of their wheat crops—for which estimates are made upon the basis of unofficial information deemed on the whole most trustworthy.

TABLE I.—*Comparative statement on the wheat product of Europe.*

Countries.	Anterior to 1874. Annual product as reported to the International Statistical Congress.		Annual product, compiled from more recent† official and other statistics.		Product for the year 1882 (partly estimated).	Product for the year 1883 (estimated).
	Year.	Bushels.	Year or period.	Bushels.	Bushels.	Bushels.
	A.	B.	C.	D.		
Austria-Hungary:						
Austria	Year 1871	35, 945, 699	Average for 1874-'81	38, 655, 470	44, 548, 149	33, 413, 680
Hungary	Average year	69, 741, 730	do	70, 990, 307	136, 481, 263	77, 762, 989
Belgium	do	23, 991, 263	Average as stated in a recent report to Department of State	24, 419, 600	24, 990, 030	21, 592, 157
Denmark	do	2, 743, 557	Average for 1875-'81	4, 574, 921	4, 803, 667	4, 500, 000
France	do	295, 654, 462	Average for 1874-'81	283, 873, 869	346, 649, 713	285, 613, 832
Germany	1873*	97, 586, 459	Average for 1878-'81	85, 339, 951	93, 823, 048	72, 779, 980
Great Britain and Ireland:						
Great Britain	Average year	104, 572, 354	Average for 1874-'81	83, 870, 875	82, 368, 935	68, 735, 592
Ireland	1873	3, 871, 932	do	4, 143, 954	4, 101, 324	2, 559, 654
Greece	1867	5, 102, 894	Year 1867	5, 102, 894	5, 102, 894	5, 102, 894
Italy	Year not stated	107, 381, 080	Average for 1874-'81	139, 290, 287	142, 259, 460	128, 172, 978
Netherlands	Average year	5, 318, 798	do	5, 609, 132	5, 889, 589	5, 700, 000
Portugal	do	8, 171, 749	Average year, per recent official statement (see text)	9, 000, 000	7, 200, 000	9, 000, 000
Roumania	do	33, 787, 161	Average for 1876-'81	25, 000, 000	30, 000, 000	20, 000, 000
Russia	1870	221, 768, 841	Average for 1874-'80	194, 094, 979	202, 907, 736	160, 000, 000
Servia	1868	4, 086, 720	Average year, as recently reported (see text)	4, 256, 730	6, 810, 768	4, 500, 000
Spain	1857	117, 563, 372	Average year, as recently stated (see text)	119, 188, 440	85, 134, 600	120, 000, 000
Sweden and Norway:						
Sweden	1872	2, 455, 429	Average for 1874-'81	3, 117, 171	3, 792, 884	3, 351, 862
Norway	Average year	276, 535	Year 1875	284, 736	290, 362	290, 362
Switzerland	1868	2, 145, 528	Year 1868	2, 145, 528	2, 145, 528	2, 145, 528
Turkey	1868	40, 867, 200	do	40, 867, 200	40, 867, 200	40, 867, 200
Total for Europe		1, 183, 032, 763		1, 143, 826, 044	1, 270, 167, 150	1, 066, 088, 688

* In the case of Bavaria, 1863, and in that of Prussia, 1867. Other German States 1873, as indicated.

† Except in the cases of Greece, Switzerland, and Turkey.

TABLE II.—*Showing the quantities of wheat product in certain European countries.*

Countries.	1874.	1875.	1876.	1877.
	Bushels.	*Bushels.*	*Bushels.*	*Bushels.*
Austria-Hungary:				
Austria	42, 011, 573	30, 890, 082	35, 050, 658	39, 870, 006
Hungary	61, 335, 771	48, 933, 308	51, 670, 405	76, 912, 536
Denmark	....	4, 695, 228	4, 098, 672	4, 002, 704
France	377, 799, 439	285, 583, 621	270, 841, 064	284, 195, 331
Germany	....	....	....	....
Great Britain and Ireland:				
Great Britain	118, 823, 000	80, 822, 000	84, 248, 000	73, 062, 000
Ireland	5, 386, 395	4, 327, 266	3, 777, 187	3, 548, 720
Netherlands	6, 782, 390	6, 385, 095	5, 448, 614	4, 974, 698
Russia	261, 308, 779	149, 803, 525	158, 654, 141	254, 557, 653
Sweden	3, 466, 261	3, 353, 294	3, 153, 994	2, 672, 440

Countries.	1878.	1879.	1880.	1881.	Average.
	Bushels.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
Austria-Hungary:					
Austria	45, 196, 713	34, 469, 859	40, 587, 154	41, 167, 716	38, 655, 470
Hungary	108, 623, 200	52, 217, 650	79, 329, 601	88, 899, 987	70, 990, 307
Denmark	5, 447, 064	5, 038, 844	5, 598, 008	3, 143, 928	4, 574, 921
France	270, 361, 092	225, 197, 665	282, 282, 380	274, 730, 364	283, 873, 869
Germany	95, 797, 617	83, 727, 684	86, 174, 152	75, 660, 351	85, 339, 951
Great Britain and Ireland:					
Great Britain	101 460, 000	55, 008, 000	79, 590, 000	77, 954, 000	83, 870, 875
Ireland	4, 307, 679	3, 358, 005	4, 158, 405	4, 287, 978	4, 143, 954
Netherlands	5, 652, 937	5, 022, 941	5, 902, 666	4, 703, 715	5, 609, 132
Russia	199, 275, 252	171, 389, 856	163, 675, 645	....	194, 094, 979
Sweden	3, 333, 641	3, 132, 497	3, 602, 395	2, 222, 845	3, 117, 171

TABLE III.—*Table showing the areas cultivated in wheat in certain European countries.*

Year.	Austria-Hungary.		France.	Germany.	Great Britain and Ireland.		Netherlands.
	Austria.	Hungary.			Great Britain.	Ireland.	
	Acres.	*Acres.*	*Acres.*	*Acres.*	*Acres.*	*Acres.*	*Acres.*
1874	2, 381, 560	5, 549, 137	16, 986, 114	....	3, 630, 300	188, 711	224, 384
1875	2, 403, 104	5, 661, 630	17, 165, 990	....	3, 342, 481	161, 321	235, 022
1876	2, 420, 422	6, 432, 138	16, 949, 721	....	2, 995, 957	119, 597	212, 041
1877	2, 321, 197	5, 971, 404	17, 239, 636	....	3, 168, 540	143, 319	221, 174
1878	2, 498, 758	6, 184, 332	16, 909, 263	4, 481, 472	3, 218, 417	154, 011	232, 136
1879	2, 426, 597	6, 090, 815	17, 152, 879	4, 486, 318	2, 890, 244	157, 508	229, 939
1880	2, 356, 349	5, 958, 142	17, 000, 171	4, 485, 433	2, 909, 438	148, 636	228, 775
1881	2, 455, 276	6, 260, 558	17, 195, 971	4, 490, 813	2, 805, 809	154, 009	218, 879
1882	2, 456, 349	6, 165, 261	17, 069, 154	4, 500, 647	3, 003, 960	152, 720	....
1883	....	....	16, 601, 979	....	2, 613, 147	94, 802	....

STATISTICS BY COUNTRIES.

Below are presented statistics of the cereal and potato crops of all the countries of Europe, for which authentic data could be obtained-covering in some cases considerable periods. Wherever it was practi, cable both the areas cultivated and the quantities produced have been given. Taking the countries in their alphabetical order, the first to be presented is—

AUSTRIA-HUNGARY.

The statistics of quantities produced for Austria and all of those for Hungary, except for the year 1882, are obtained from the official publications of the two countries. For Austria no official statistics of acreage under the different crops have been found, except for the years 1880 and 1882, and the figures for other years, given in the table on that subject, are taken from the British Statistical Abstract for Foreign Countries, Nos. 6, 8, and 9.* Those for Hungary for 1882 are taken

* Those on maslin and potatoes for 1880 are from the same source. Maslin is a mixture of wheat and rye.

from the *Bulletin* issued by the French department of agriculture, but purport to be derived from an official source by the French consul at Buda-Pesth.

AUSTRIA.—The following table shows the number of acres cultivated in wheat, rye, maslin, and barley for the years 1874 to 1882, inclusive:

Years.	Wheat.	Rye.	Maslin.	Barley.
	Acres.	*Acres.*	*Acres.*	*Acres.*
1874	2, 381, 560	4, 834, 124	43, 053	2, 731, 589
1875	2, 403, 104	4, 810, 256	49, 255	2, 692, 979
1876	2, 420, 422	4, 816, 982	48, 963	2, 753, 376
1877	2, 321, 197	4, 798, 696	48, 829	2, 663, 783
1878	2, 498, 758	4, 774, 260	50, 976	2, 612, 286
1879	2, 426, 597	4, 759, 176	46, 105	2, 560, 360
1880	2, 356, 349	4, 548, 721	54, 204	2, 666, 118
1881	2, 455, 276	4, 628, 068	52, 801	2, 581, 506
1882	2, 456, 349	*4, 570, 624	....	2, 666, 103

* For the year 1882 spelt is included with rye.

The following table shows the acreage under oats, buckwheat, maize, and potatoes for the same years:

Year.	Oats.	Buckwheat.	Maize.	Potatoes.
	Acres.	*Acres.*	*Acres.*	*Acres.*
1874	4, 415, 938	330, 502	754, 060	2, 301, 509
1875	4, 348, 887	311, 949	772, 653	2, 349, 649
1876	4, 412, 660	346, 798	771, 826	2, 410, 426
1877	4, 493, 663	345, 209	818, 116	2, 401, 267
1878	4, 421, 930	343, 498	809, 552	2, 402, 718
1879	4, 442, 186	386, 770	794, 458	2, 429, 171
1880	4, 436, 789	420, 386	828, 151	2, 457, 000
1881	4, 398, 500	419, 507	816, 220	2, 449, 405
1882	4, 436, 789	430, 386	828, 161	2, 457, 995

The following tables show for the same years the yield in bushels for the principal cereals and potatoes:

Wheat, rye, spelt, and maslin.

Years.	Wheat.	Rye.	Spelt.	Maslin.
	Bushels.	*Bushels.*	*Bushels.*	*Bushels.*
1874	*42, 011, 573	80, 689, 385	(*)	1, 322, 387
1875	30, 890, 082	65, 551, 434	498, 670	833, 158
1876	35, 050, 658	60, 764, 750	560, 387	946, 439
1877	39, 870, 006	79, 458, 900	484, 924	897, 818
1878	45, 196, 713	84, 498, 917	622, 467	1, 084, 748
1879	34, 469, 859	63, 393, 737	60, 573	821, 855
1880	40, 587, 154	64, 335, 678	281, 021	....
1881	41, 167, 716	80, 014, 634	228, 984	1, 095, 171
1882	44, 548, 149	82, 231, 280	289, 004	980, 986

* For the year 1874 spelt is included with wheat.

Barley, oats, millet, buckwheat, maize, and potatoes.

Years.	Barley.	Oats.	Millet.	Buckwheat.	Maize.	Potatoes.
	Bushels.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
1874	49, 547, 514	79, 666, 717	....	....	16, 438, 447	266, 978, 479
1875	37, 387, 379	72, 546, 240	2, 606, 180	6, 229, 489	17, 234, 294	265, 221, 678
1876	51, 461, 471	93, 879, 598	2, 810, 571	7, 788, 167	16, 795, 124	259, 045, 952
1877	39, 209, 597	86, 016, 697	2, 461, 531	6, 257, 541	14, 589, 125	268, 229, 671
1878	48, 487, 347	98, 103, 630	3, 173, 520	8, 741, 524	19, 278, 217	260, 669, 477
1879	37, 666, 092	86, 273, 468	2, 324, 115	8, 093, 023	15, 480, 024	162, 883, 200
1880	50, 539, 389	92, 741, 036	2, 619, 421	7, 920, 554	17, 189, 811	243, 399, 225
1881	46, 781, 264	95, 374, 959	2, 260, 375	8, 277, 694	12, 934, 784	282, 518, 659
1882	48, 899, 711	91, 583, 330	2, 316, 850	6, 235, 250	15, 718, 719	243, 721, 488

HUNGARY.—The two tables next following show the areas cultivated in the principal cereals and potatoes:

Wheat (winter and spring), rye, spelt, and maslin.

Years.	Winter wheat.	Spring wheat.	Total wheat.	Rye.	Spelt.	Maslin.
	Acres.	*Acres.*	*Acres.*	*Acres.*	*Acres.*	*Acres.*
1874	5, 019, 481	529, 656	5, 549, 137	2, 940, 399	15, 202	655, 173
1875	5, 226, 674	435, 556	5, 661, 630	2, 975, 665	12, 031	621, 456
1876	5, 983, 281	445, 857	6, 432, 138	3, 435, 602	9, 039	619, 611
1877	5, 558, 663	412, 741	5, 971, 404	3, 091, 619	9, 471	583, 366
1878	5, 756, 034	428, 298	6, 184, 332	3, 257, 628	8, 708	594, 389
1879	5, 681, 709	409, 106	6, 090, 815	2, 959, 660	8, 639	567, 440
1880	5, 570, 336	387, 806	5, 958, 142	2, 682, 216	10, 979	531, 665
1881	5, 841, 763	418, 795	6, 260, 558	2, 688, 576	8, 772	505, 475
1882	5, 715, 533	449, 728	6, 165, 261	2, 689, 815	8, 574	505, 055

Barley, oats, millet, buckwheat, maize, and potatoes.

Years.	Barley.	Oats.	Millet.	Buckwheat.	Maize.	Potatoes.
	Acres.	*Acres.*	*Acres.*	*Acres.*	*Acres.*	*Acres.*
1874	2, 340, 909	2, 589, 687	97, 451	52, 590	3, 959, 869	889, 637
1875	2, 244, 530	2, 432, 099	111, 010	43, 848	4, 362, 041	944, 923
1876	2, 664, 729	3, 063, 331	162, 125	65, 064	5, 937, 077	1, 237, 455
1877	2, 299, 181	2, 686, 308	83, 372	41, 493	4, 346, 781	1, 055, 026
1878	2, 471, 138	2, 853, 328	120, 209	52, 593	4, 679, 036	1, 150, 596
1870	2, 428, 494	2, 690, 388	123, 473	44, 755	4, 633, 108	1, 015, 497
1880	2, 417, 645	2, 514, 645	126, 525	36, 976	4, 610, 535	891, 826
1881	2, 250, 453	2, 361, 517	136, 001	48, 276	4, 439, 117	917, 962
1882	2, 399, 454	2, 468, 334	107, 892	42, 854	4, 680, 653	953, 479

The two tables which follow show for the same products the quantities produced during the same years:

Wheat (winter and spring), rye, spelt, and maslin.

Years.	Winter wheat.	Spring wheat.	Total wheat.	Rye.	Spelt.	Maslin.
	Bushels.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
1874	56, 283, 733	5, 052, 038	61, 335, 771	34, 609, 522	213, 705	7, 689, 192
1875	46, 231, 499	2, 701, 809	48, 933, 308	29, 816, 521	130, 018	6, 533, 794
1876	49, 160, 915	2, 509, 490	51, 670, 405	25, 353, 805	81, 951	4, 404, 041
1877	73, 469, 616	3, 442, 920	76, 912, 536	37, 934, 346	116, 640	6, 870, 811
1878	103, 481, 274	5, 141, 926	108, 623, 200	51, 956, 128	95, 124	8, 738, 335
1879	49, 201, 062	3, 016, 588	52, 217, 650	24, 112, 409	102, 746	5, 628, 163
1880	74, 294, 465	5, 035, 136	79, 329, 601	34, 445, 440	147, 019	6, 604, 410
1881	84, 020, 219	4, 879, 768	88, 899, 987	40, 192, 241	132, 608	7, 367, 713
1882	128, 645, 784	7, 835, 479	136, 481, 263	50, 414, 446	202, 941	10, 384, 449

Barley, oats, millet, buckwheat, maize, and potatoes.

Years.	Barley.	Oats.	Millet.	Buckwheat.	Maize.	Potatoes.
	Bushels.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
1874	35, 329, 181	39, 814, 374	893, 862	585, 647	21, 573, 882	44, 025, 441
1875	21, 592, 992	22, 216, 274	1, 216, 630	308, 287	79, 849, 228	40, 998, 221
1876	31, 547, 298	39, 316, 327	1, 559, 850	479, 350	65, 178, 936	49, 428, 811
1877	34, 458, 762	40, 114, 734	977, 050	282, 303	54, 202, 464	45, 988, 269
1878	47, 417, 782	60, 170, 048	2, 174, 883	378, 985	102, 867, 970	92, 007, 119
1879	26, 202, 177	38, 253, 899	1, 902, 781	320, 219	65, 958, 746	44, 982, 370
1880	50, 920, 216	61, 662, 046	1, 938, 248	266, 480	98, 774, 278	88, 040, 522
1881	39, 912, 727	47, 810, 845	1, 971, 837	587, 310	81, 917, 196	86, 255, 315
1882	59, 629, 428	63, 911, 175	1, 938, 064	669, 551	111, 280, 949	85, 691, 123

BELGIUM.

The statistical material on the subject of agriculture furnished by the Belgian Government is very scanty. The facts which follow are obtained from a report to the Department of State made by Mr. George C. Tanner, United States consul at Liege and Verviers, under date of March

29, 1883. Consul Tanner estimates the average production of all grain at 64,013,113 bushels, and gives statistics for 1882, embracing the area cultivated in the principal cereals and potatoes, and, except in the case of maslin, the produce per acre, from which the total product is calculated as below. The following table embraces the facts furnished:

Cereal and potato crops of 1882.

Product.	Acres cultivated.	Yield per acre.	Total products.
		Bushels.	*Bushels.*
Wheat	895, 700	27. 9	24, 990, 030
Rye	713, 113	25. 4	18, 113, 070
Maslin	88, 000	Not known..	Not known.
Barley	120, 000	35. 1	4, 212, 000
Oats	567, 727	42. 5	24, 128, 397
Buckwheat	35, 000	24. 9	871, 500
Potatoes	400, 000	194. 0	7, 760, 000

DENMARK.

The most authentic information at hand in regard to Denmark is found in a report to the Department of State, made in 1882 by Consul Henry B. Ryder, of Copenhagen. The following statement in regard to areas sown shows the breadth of land under each of the crops mentioned on the 17th of July, 1876, that being the only year for which statistics of acreage could be obtained:

Crop.	Area sown.	Quantity sown.
	Acres.	*Bushels.*
Wheat	157, 192	421, 300
Rye	644. 059	1, 791, 892
Barley	782, 859	2, 221, 220
Oats	968, 108	3, 986, 876
Buckwheat	55, 761	80, 064
Pease, &c	92, 088	288, 952
Mixed seeds	123, 833	418, 936

The following table shows the quantities of the principal cereals produced in Denmark during the years 1875–'81:

Years.	Wheat.	Rye.	Barley.	Oats.	Buckwheat.	Mixed seed.*
	Bushels.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
1875	4, 695, 228	16, 839, 276	23, 242, 716	30, 475, 940	729, 164	2, 510, 868
1876	4, 098, 672	14, 516, 936	18, 944, 800	25, 543, 940	492, 504	3, 422, 628
1877	4, 002, 704	15, 962, 928	19, 935, 720	25, 986, 180	987, 204	3, 609, 256
1878	5, 447, 064	17, 271, 300	24, 047, 296	33, 133, 724	997, 180	4, 384, 748
1879	5, 038, 844	14, 557, 088	20, 468, 384	29, 435, 500	560, 072	3, 914, 776
1880	5, 598, 008	18, 119, 472	24, 955, 752	33, 526, 584	1, 040, 564	4, 471, 544
1881	3, 143, 928	16, 618, 960	21, 548, 564	29, 524, 012	768, 848	3, 820, 948

FRANCE.

The statistics for France given below are all obtained from official publications of the French Government, chiefly from the *Bulletin* issued by the ministry of agriculture. The figures for 1883 must, however, be regarded as an official estimate rather than a definitive official statement.

The following table shows the production of wheat, the imports and exports of the same cereal (including flour), the average price of wheat per hectoliter and per 100 kilograms, and also the population of France for each of the years 1860–'61 to 1883–'84, inclusive:

The production of wheat in France and the imports and exports (including flour) for the past 24 years.

Year.	Hectares sown.	Yield per acre.	Total production.	For sowing.	Available for food.	Imports.	Exports.	Total amount available for consumption.	Population.	Average price of wheat by— Hectoliter.	Average price of wheat by— 100 kil.
			Hectoliters.	*Hectoliters.*		*Hectoliters.*	*Hectoliters.*			*Francs.*	*Frs.*
1883-'84	6,718,729	14.98	100,646,216	15,870,016	84,776,200	....	....	....	....	....	....
1882-'83	6,907,792	17.70	122,153,524	15,453,076	106,700,448	15,142,106	....	121,842,554	37,820,000	21.51	27.69
1881-'82	6,959,114	13.91	96,810,356	15,887,940	80,922,416	15,307,374	....	96,229,790	37,672,048	22.28	28.82
1880-'81	6,879,875	14.57	99,471,550	16,005,930	83,465,629	21,323,396	....	104,789,025	37,520,000	22.90	29.96
1879-'80	6,941,675	11.43	79,355,866	15,823,770	63,532,096	29,116,294	....	92,648,390	37,360,000	21.92	28.20
1878-'79	6,843,085	13.92	95,270,698	15,965,798	79,304,900	29,117,177	....	108,422,077	37,210,000	33.08	29.96
1877-'78	6,976,785	14.35	100,145,651	15,739,130	84,406,521	6,850,995	....	91,257,516	37,055,000	23.42	30.01
1876-'77	6,859,458	13.90	95,439,832	16,046,640	79,393,192	178,903	....	79,572,095	36,905,788	20.59	26.71
1875-'76	6,946,981	14.48	100,634,861	15,776,850	84,858,011	1,020,481	....	85,878,492	36,710,000	19.32	23.93
1874-'75	6,874,186	19.36	133,130,163	15,878,100	117,252,063	....	1,599,811	115,652,252	36,515,000	25.11	31.88
1873-'74	6,825,948	11.99	81,892,667	15,810,627	66,082,040	14,966,932	....	81,048,972	36,310,000	25.62	33.48
1872-'73	6,937,922	17.41	120,803,459	15,099,680	105,703,779	....	2,220,209	103,483,570	36,102,921	23.15	30.43
1871-'72	6,422,883	10.78	69,276,419	15,957,220	53,319,199	15,650,628	....	68,969,827	36,010,000	25.65	34.20
*1870-'71	....	....	....	....	....			....	37,551,400	20.56	27.05
1869-'70	7,034,087	15.34	107,941,553	14,772,630	93,168,923	2,778,223	....	95,947,146	37,506,300	20.33	26.57
1868-'69	7,062,811	16.17	116,783,000	16,178,400	100,604,600	850,578	....	101,455,178	37,366,800	26.64	35.05
1867-'68	6,960,425	11.92	83,005,739	16,244,534	66,761,205	15,275,316	....	82,036,521	37,225,600	26.19	34.46
1866-'67	6,915,565	12.33	85,131,455	16,008,977	69,122,478	3,743,812	....	72,866,290	37,081,622	19.61	25.48
1865-'66	6,904,892	13.84	95,571,609	15,905,799	79,665,810	....	9,057,604	70,608,206	36,952,700	16.41	21.59
1864-'65	6,880,073	16.15	111,274,018	15,881,251	95,392,767	....	1,653,728	93,739,039	36,824,300	17.58	23.13
1863-'64	6,918,768	16.88	116,781,794	15,824,168	100,957,626	....	791,076	100,166,550	36,690,500	10.78	26.02
1862-'63	6,881,613	14.43	99,292,224	15,913,166	83,379,058	2,916,910	....	86,295,968	36,556,200	23.24	30.37
1861-'62	6,754,227	11.12	75,116,287	15,827,709	59,288,578	15,623,616	....	74,912,194	36,424,054	24.55	32.30
1860-'61	6,711,298	15.13	101,573,625	15,534,722	86,038,903	....	1,034,244	85,004,659	36,290,000	20.24	26.45

*Year of the Franco-German war.

The following table shows the areas sown in wheat, maslin, rye, and barley in France for the years 1872–'82, with the average for the ten years, 1872–'81:

Years.	Wheat.	Maslin.	Rye.	Barley.
	Acres.	*Acres.*	*Acres.*	*Acres.*
1872	17, 143, 605	1, 236, 476	4, 732, 353	2, 670, 570
1873	16, 866, 918	1, 249, 095	4, 689, 291	2, 709, 382
1874	16, 986, 114	1, 264, 505	4, 623, 441	2, 713, 338
1875	17, 165, 990	1, 189, 947	4, 679, 763	2, 579, 484
1876	16, 949, 721	1, 168, 788	4, 541, 434	2, 667, 057
1877	17, 239, 636	1, 147, 510	4, 562, 622	2, 632, 428
1878	16, 909, 263	1, 093, 808	4, 459, 639	2, 497, 002
1879	17, 152, 879	990, 110	4, 375, 056	2, 537, 673
1880	17, 000, 171	1, 015, 047	4, 566, 672	2, 600, 372
1881	17, 195, 971	991, 901	4, 391, 629	2, 530, 158
Yearly average for 1872–'81	17, 061, 024	1, 134, 718	4, 562, 180	3, 613, 747
1882	17, 069, 154	979, 297	4, 623, 369	2, 458, 660

The following table shows the areas sown in oats, buckwheat, maize, and potatoes in France for the years 1872–'82, with the average for the ten years, 1872–'81:

Years.	Oats.	Buckwheat.	Maize.	Potatoes.
	Acres.	*Acres.*	*Acres.*	*Acres.*
1872	7, 929, 058	1, 679, 287	1, 726, 886	2, 841, 378
1873	7, 984, 960	1, 707, 026	1, 664, 508	2, 839, 621
1874	7, 804, 915	1, 676, 289	1, 606, 632	3, 236, 175
1875	7, 874, 780	1, 627, 527	1, 643, 951	3, 017, 375
1876	8, 651, 013	1, 630, 979	1, 633, 632	3, 086, 870
1877	8, 299, 239	1, 638, 439	1, 636, 091	3, 129, 872
1878	8, 218, 553	1, 638, 634	1, 519, 845	3, 125, 662
1879	8, 511, 233	1, 550, 629	1, 513, 685	3, 104, 750
1880	8, 584, 044	1, 598, 888	1, 541, 163	3, 220, 860
1881	8, 587, 244	1, 560, 916	1, 501, 409	3, 344, 219
Yearly average for 1872–'81	8, 219, 791	1, 630, 862	1, 598, 779	3, 094, 675
1882	8, 691, 278	1, 590, 817	1, 558, 106	3, 322, 395

The following table shows the quantities of wheat, maslin, rye, and barley produced in France for the years 1872–'82, with the annual average for the ten years 1872–'81:

Years.	Wheat.	Maslin.	Rye.	Barley.
	Bushels.	*Bushels.*	*Bushels.*	*Bushels.*
1872	342, 818, 472	25, 461, 134	84, 761, 640	59, 214, 349
1873	232, 396, 648	18, 035, 546	57, 664, 568	53, 819, 475
1874	377, 799, 439	28, 078, 060	80, 508, 437	55, 836, 722
1875	285, 583, 621	20, 948, 600	76, 391, 631	51, 490, 405
1876	270, 841, 064	20, 223, 523	75, 163, 936	52, 673, 384
1877	284, 195, 331	20, 173, 237	70, 936, 501	49, 340, 983
1878	270, 361, 092	17, 594, 101	68, 642, 567	46, 602, 618
1879	225, 197, 665	12, 926, 858	53, 609, 507	46, 081, 960
1880	282, 282, 380	17, 087, 380	71, 849, 306	56, 212, 722
1881	274, 730, 364	17, 047, 886	67, 346, 097	49, 900, 831
Annual average for 1872–'81	284, 620, 604	19, 757, 689	70, 687, 417	50, 698, 435
1882	346, 649, 713	20, 610, 970	83, 679, 079	55, 032, 643

The following table shows the quantities of oats, buckwheat, maize, and potatoes produced in France for the years 1872–'82, with the annual average for the ten years 1872–'81:

Years.	Oats.	Buckwheat.	Maize.	Potatoes.
	Bushels.	*Bushels.*	*Bushels.*	*Bushels.*
1872	230, 223, 832	30, 164, 162	32, 070, 777	300, 003, 535
1873	217, 865, 469	26, 170, 509	27, 021, 396	335, 258, 392
1874	193, 929, 269	34, 104, 078	30, 587, 854	400, 470, 789
1875	197, 232, 622	25, 998, 926	29, 579, 986	355, 651, 636
1876	209, 300, 823	16, 755, 525	29, 135, 698	331, 799, 586
1877	195, 746, 858	31, 188, 119	30, 384, 025	343, 899, 497
1878	219, 334, 509	32, 651, 199	29, 905, 818	318, 110, 530
1879	210, 741, 000	26, 021, 952	21, 028, 802	267, 905, 606
1880	237, 782, 289	29, 650, 676	27, 413, 855	393, 229, 635
1881	219, 215, 951	30, 119, 804	23, 845, 052	378, 303, 513
Average for 10 years	213, 137, 264	28, 282, 492	27, 197, 894	342, 463, 211
1882	254, 546, 495	31, 004, 023	27, 464, 552	317, 825, 805

GERMANY.

The following table shows the area of lands cultivated in the principal cereals and potatoes in the German Empire for the years 1878 to 1882, inclusive:

Product.	1878.	1879.	1880.	1881.	1882.
	Acres.	*Acres.*	*Acres.*	*Acres.*	*Acres.*
Wheat	4, 481, 472	4, 486, 318	4, 485, 433	4, 490, 813	4, 500, 647
Rye	14, 675, 788	14, 649, 988	14, 629, 971	14, 612, 221	14, 646, 136
Barley	4, 003, 796	4, 015, 397	4, 012, 902	4, 035, 830	4, 033, 688
Oats	9, 246, 603	9, 256, 608	9, 249, 576	9, 252, 993	9, 251, 921
Spelt*	975, 321	967, 720	954, 836	933, 902	945, 966
Buckwheat	607, 965	601, 286	604, 515	604, 515	604, 617
Potatoes†	6, 803, 197	6, 815, 532	6, 827, 210	6, 838, 586	6, 833, 667

* Including *emer*. † Sound and unsound.

The following table shows for the same products the quantities produced during the same years:

Product.	1878.	1879.	1880.	1881.	1882.
	Bushels.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
Wheat	95, 797, 617	83, 727, 684	86, 174, 152	75, 660, 351	93, 823, 048
Rye	272, 415, 057	218, 983, 232	194, 972, 154	214, 494, 033	251, 579, 026
Barley	106, 796, 756	94, 493, 639	98, 547, 339	95, 357, 207	103, 633, 492
Oats	347, 244, 342	293, 783, 316	291, 294, 368	259, 028, 431	310, 579, 841
Spelt*	17, 594, 686	18, 120, 725	19, 264, 451	17, 677, 242	18, 044, 744
Buckwheat	10, 329, 706	6, 504, 596	6, 139, 594	5, 656, 874	6, 487, 694
Potatoes†	866, 885, 674	694, 624, 489	715, 261, 432	936, 634, 040	663, 933, 813

* Including *emer*. † Sound and unsound.

In the German official reports, from which the above table was compiled, the quantities were expressed in tons of 1,000 kilograms. In reducing these quantities to bushels, the German tons were reduced to pounds and the result divided by 60 for wheat, 56 for rye, 48 for barley, 32 for oats, 56 for spelt, 48 for buckwheat, and 60 for potatoes.

GREAT BRITAIN AND IRELAND.

The British Government does not publish statistics of production as to England, Wales, or Scotland, though it does as to Ireland. Statistics of the acreage under crops are, however, published as to each division of the kingdom.

GREAT BRITAIN.—The following table shows the number of acres cultivated in wheat, barley or bere, oats, and potatoes for the years 1867 to 1883, inclusive, and for rye from 1867 to 1882, inclusive:

Years.	Wheat.	Barley, or bere.	Oats.	Rye.	Potatoes.
	Acres.	*Acres.*	*Acres.*	*Acres.*	*Acres.*
1867	3, 367, 876	2, 259, 164	2, 750, 487	52, 865	492, 217
1868	3, 652, 125	2, 151, 324	2, 757, 053	46, 896	541, 543
1869	3, 688, 357	2, 251, 480	2, 782, 720	64, 099	585, 211
1870	3, 500, 543	2, 371, 739	2, 763, 300	65, 166	587, 661
1871	3, 571, 894	2, 385, 783	2, 715, 707	71, 495	627, 691
1872	3, 598, 957	2, 316, 332	2, 705, 837	66, 875	564, 088
1873	3, 490, 380	2, 335, 913	2, 676, 227	51, 634	514, 682
1874	3, 630, 300	2, 287, 987	2, 596, 384	47, 228	520, 430
1875	3, 342, 481	2, 509, 701	2, 664, 009	54, 903	522, 652
1876	2, 995, 957	2, 533, 109	2, 798, 430	56, 210	502, 719
1877	3, 168, 540	2, 417, 588	2, 754, 179	60, 146	512, 471
1878	3, 218, 417	2, 469, 652	2, 698, 907	60, 117	508, 431
1879	2, 890, 244	2, 667, 176	2, 656, 628	49, 127	541, 344
1880	2, 909, 438	2, 467, 441	2, 796, 905	40, 781	550, 932
1881	2, 805, 809	2, 442, 334	2, 901, 275	41, 567	579, 334
1882	3, 003, 960	2, 255, 269	2, 833, 865	56, 553	541, 064
1883	2, 613, 147	2, 291, 984	2, 975, 377	....	543, 455

IRELAND.—The following table shows for Ireland the acreage under the same crops for 1867–'83:

Years.	Wheat.	Barley, or bere.	Oats.	Rye.	Potatoes.
	Acres.	*Acres.*	*Acres.*	*Acres.*	*Acres.*
1867	261, 034	172, 932	1, 660, 511	7, 671	1, 001, 781
1868	286, 790	188, 252	1, 699, 919	7, 854	1, 034, 853
1869	281, 117	223, 338	1, 664, 788	8, 770	1, 041, 837
1870	260, 914	243, 435	1, 648, 764	9, 281	1, 043, 788
1871	246, 954	222, 604	1, 633, 960	9, 647	1, 058, 287
1872	228, 189	220, 057	1, 621, 813	8, 832	991, 802
1873	168, 435	231, 023	1, 510, 089	8, 405	903, 282
1874	188, 711	212, 230	1, 480, 186	8, 979	892, 421
1875	161, 321	234, 503	1, 499, 371	9, 556	900, 277
1876	119, 597	221, 263	1, 487, 086	8, 631	880, 693
1877	143, 319	226, 603	1, 471, 698	10, 441	871, 522
1878	154, 011	244, 504	1, 412, 637	10, 864	846, 985
1879	157, 508	254, 845	1, 330, 212	9, 086	842, 621
1880	148, 636	218, 579	1, 381, 943	7, 108	820, 728
1881	154, 009	211, 150	1, 392, 365	7, 459	854, 294
1882	152, 720	187, 805	1, 397, 304	7, 772	837, 919
1883	94, 802	*183, 700	1, 380, 871	*7, 565	806, 664

* For the year 1883 bere is included with rye instead of barley.

Product of grain and potatoes in Ireland for the years 1874 *to* 1881.

Years.	Wheat.	Oats.	Barley.	Bere.	Rye.	Potatoes.
	Bushels.	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*	*Bushels.*
1874	5, 386, 395	70, 024, 301	9, 497, 364	35, 632	204, 056	132, 593, 253
1875	4, 327, 266	80, 242, 505	9, 899, 633	29, 017	243, 296	131, 147, 669
1876	3, 777, 187	74, 953, 186	9, 052, 232	26, 068	257, 580	155, 111, 973
1877	3, 548, 720	62, 462, 971	8, 184, 783	23, 683	259, 906	65, 604, 933
1878	4, 307, 679	66, 656, 258	9, 141, 309	23, 100	306, 376	94, 322, 816
1879	3, 358, 005	54, 364, 202	7, 608, 557	15, 783	158, 400	41, 577, 237
1880	4, 158, 405	68, 454, 645	8, 037, 031	19, 192	145, 920	111, 472, 069
1881	4, 287, 978	68, 960, 759	7, 762, 804	16, 053	159, 892	128, 187, 472

ITALY.

The Italian Government has not until recently published yearly statistics of agriculture, but has occasionally prepared statements showing the average areas under the different crops, and the average quantities produced for periods of several years. The following table is compiled from a report to the Department of State, by Mr. Lewis Richmond, consul-general of the United States for Italy:

Areas cultivated in the principal cereals.

Years.	Wheat.	Indian corn.	Rye and barley.	Oats.
	Acres.	*Acres.*	*Acres.*	*Acres.*
1872–1879 (annual average)	10, 855, 189	4, 213, 256	1, 184, 651	939, 574
1880–1881 (annual average)	11, 550, 792	4, 190, 919	1, 146, 911	967, 084

In the following table on quantities produced the figures for 1872–'79, and those for 1880 and 1881, are obtained from the report of Consul-General Richmond above mentioned, and those for 1882 and 1883 from the *Bolletino di Notizie Agrarie*, published by the Italian ministry of agriculture, industry, and commerce:

Quantities of the principal cereals produced.

Years.	Wheat.	Indian corn.	Rye and barley.	Oats.
	Bushels.	*Bushels.*	*Bushels.*	*Bushels.*
1872–'79 (annual average)	138, 957, 520	87, 167, 424	16, 706, 873	18, 455, 941
1880	164, 818, 894	81, 074, 888	18, 626, 188	19, 089, 560
1881	100, 708, 461	55, 199, 007	12, 784, 815	13, 389, 636
1882	142, 259, 460	....	16, 715, 041	16, 823, 335
1883	128, 172, 978	*81, 655, 433	....	....

* Official estimate.

The figures taken from Consul-General Richmond's report, as above stated, may be regarded as official, having been obtained by him from the chief of the Italian bureau of statistics, and from the secretary to the minister of agriculture and commerce.

KINGDOM OF THE NETHERLANDS.

The following statistics of the Netherlands are compiled mainly from the *Résumé Statistique*, prepared from official data by the Statistical Society of the Netherlands, but the figures for 1881 are taken from an official report on agriculture, prepared under the direction of the minister of water inspection, commerce, and industry. The two tables which follow, show the areas cultivated in the principal cereals and potatoes for the years 1870 to 1881, inclusive, with the average areas for the decades 1871 to 1880, 1861 to 1870, and 1851 to 1860:

Areas cultivated.

Years.	Wheat.	Spelt.	Rye.
	Acres.	*Acres.*	*Acres.*
1870	208, 748	885	501, 442
1871	140, 830	455	404, 122
1872	212, 046	675	493, 839
1873	214, 159	647	487, 775
1874	224, 384	966	493, 795
1875	235, 022	1, 075	500, 185
1876	212, 041	761	492, 782
1877	221, 174	937	494, 838
1878	232, 136	776	503, 041
1879	229, 939	983	497, 108
1880	228, 775	699	487, 593
1881	218, 879	....	485, 532
Annual average for 1871–'80	215, 051	798	485, 514
Annual average for 1861–'70	207, 440	875	488, 549
Annual average for 1851–'60	200, 966	578	466, 327

Years.	Barley.	Oats.	Buckwheat.	Potatoes.
	Acres.	*Acres.*	*Acres.*	*Acres.*
1870	116, 270	259, 252	167, 771	303, 488
1871	143, 328	346, 177	183, 724	313, 716
1872	111, 857	246, 752	165, 335	312, 455
1873	134, 746	257, 402	163, 822	330, 274
1874	108, 934	253, 433	162, 844	323, 852
1875	122, 265	277, 681	162, 337	327, 118
1876	116, 770	285, 811	164, 633	326, 822
1877	112, 930	292, 174	160, 516	337, 425
1878	112, 695	273, 802	154, 951	343, 894
1879	117, 466	282, 257	135, 285	351, 638
1880	117, 350	290, 973	146, 061	347, 415
1881	115, 727	293, 602	139, 424	348, 774
Annual average for 1871–'80	119, 834	280, 646	159, 916	331, 460
Annual average for 1861–'70	107, 906	246, 198	167, 713	....
Annual average for 1851–'60	107, 615	207, 650	159, 342	....

Quantities produced.

Years.	Wheat.	Spelt.	Rye.
	Bushels.	*Bushels.*	*Bushels.*
1870	5, 834, 558	42, 567	11, 044, 795
1871	3, 377, 006	11, 351	6, 961, 172
1872	5, 536, 587	31, 216	11, 260, 470
1873	5, 204, 562	28, 378	8, 116, 165
1874	6, 782, 390	56, 756	10, 956, 014
1875	6, 385, 095	56, 756	10, 122, 504
1876	5, 448, 614	34, 054	9, 705, 344
1877	4, 974, 698	28, 378	10, 250, 206
1878	5, 652, 937	28, 378	9, 952, 235
1879	5, 022, 941	22, 703	9, 557, 778
1880	5, 902, 666	28, 378	9, 367, 644
1881	4, 703, 715	....	8, 427, 048
Annual average for 1871–'80	5, 428, 750	32, 635	9, 594, 958
Annual average for 1861–'70	5, 000, 239	39, 729	9, 654, 264
Annual average for 1851–'60	4, 452, 540	19, 865	9, 637, 237

Years.	Barley.	Oats.	Buckwheat.	Potatoes.
	Bushels.	*Bushels.*	*Bushels.*	*Bushels.*
1870	5, 247, 129	11, 615, 197	2, 738, 496	4, 666, 376
1871	5, 780, 639	16, 167, 061	3, 876, 462	37, 717, 466
1872	4, 736, 322	10, 851, 824	2, 891, 739	53, 152, 369
1873	4, 696, 592	11, 115, 741	2, 698, 767	50, 796, 978
1874	4, 710, 781	11, 615, 197	2, 857, 685	57, 712, 745
1875	5, 499, 695	13, 051, 134	3, 504, 708	56, 220, 052
1876	4, 838, 483	12, 801, 406	2, 437, 687	53, 995, 201
1877	4, 009, 840	11, 737, 224	3, 530, 248	48, 467, 128
1878	4, 072, 272	11, 487, 495	3, 320, 249	44, 428, 910
1879	4, 112, 001	12, 009, 654	2, 560, 390	29, 320, 356
1880	4, 969, 023	13, 527, 888	2, 000, 119	39, 510, 968
1881	4, 373 455	11 889, 030	2, 214, 757	64, 749, 878
Annual average for 1871–80	4, 742, 565	12, 436, 462	3, 007, 805	47, 132, 217
Annual average for 1861–70	4, 546, 188	10, 800, 743	3, 272, 006	....
Annual average for 1851–60	4, 052, 407	8, 033, 868	3, 459, 303	....

ROUMANIA.

The following statement in regard to the cereal production of Roumania is taken from a report made to the Department of State by Consul-General Eugene Schuyler, of Bucharest. The areas under the various cereal crops are not accurately known, and no account is taken of changes from year to year. It was estimated that in 1881 the cultivated land in the kingdom was divided as follows:

	Acres.
Maize	4, 423, 800
Wheat	2, 717, 420
Barley	2, 325, 055
Rye	368, 520
Oats	297, 630
Buckwheat	30, 230
Millet and small grains	278, 000
Colza	202, 000
Hemp	42, 000
Flax	23, 000

2. The average annual production of Roumania is estimated as follows:

	Bushels.
Maize	43, 000, 000
Wheat	25, 000, 000
Barley	26, 000, 000
Rye	3, 500, 000
Oats	5, 000, 000
Millet	2, 000, 000
Buckwheat	350, 000
Colza	1, 000, 000

RUSSIA.

The following table shows the production in bushels of the principal cereals and potatoes for 1874–1880:

	1874.	1875.	1876.
	Bushels.	*Bushels.*	*Bushels.*
Wheat, winter	78, 757, 975	43, 797, 446	56, 764, 254
Wheat, summer	144, 170, 340	90, 806, 367	89, 697, 956
Wheat, total	261, 308, 779	149, 803, 525	158, 654, 141
Rye	719, 526, 492	558, 744, 272	536, 308, 020
Oats	478, 421, 656	408, 271, 888	521, 340, 592
Barley	117, 136, 652	89, 584, 196	130, 918, 836
Buckwheat	68, 845, 404	65, 460, 609	91, 369, 805
Other cereals	95, 130, 423	80, 950, 974	96, 777, 257
Total cereals	1, 723, 341, 326	1, 352, 815, 464	1, 535, 368, 651
Potatoes	340, 206, 720	351, 094, 288	392, 417, 016

	1877.	1878.	1879.	1880.
	Bushels.	*Bushels.*	*Bushels.*	*Bushels.*
Wheat, winter	73, 026, 516	80, 043, 875	61, 704, 756	....
Wheat, summer	147, 951, 209	107, 396, 805	89, 369, 184	....
Wheat, total	254, 557, 653	199, 275, 252	171, 389, 856	163, 675, 645
Rye	643, 087, 188	729, 502, 792	572, 264, 392	518, 032, 630
Oats	505, 682, 268	552, 103, 332	530, 816, 588	504, 347, 528
Barley	137, 404, 920	125, 760, 940	124, 408, 928	}
Buckwheat	86, 349, 492	90, 243, 525	72, 455, 931	} 305, 772, 702
Other cereals	97, 670, 657	98, 141, 181	96, 495, 538	}
Total cereals	1, 724, 752, 179	1, 795, 027, 023	1, 567, 831, 234	1, 491, 829, 100
Potatoes	385, 216, 212	396, 741, 072	347, 422, 392	398, 786, 362

SWEDEN.

The following tables show the production of the principal cereals and potatoes in Sweden for the years 1874–'82:

Wheat, rye, and mixed grain.

Years.	Wheat.	Rye.	Mixed grain.
	Bushels.	*Bushels.*	*Bushels.*
1874	3, 466, 261	17, 980, 555	4, 372, 871
1875	3, 353, 294	19, 095, 000	5, 507, 864
1876	3, 153, 994	18, 738, 626	5, 028, 677
1877	2, 672, 440	15, 833, 542	4, 671, 077
1878	3, 333, 641	18, 778, 054	5, 640, 297
1879	3, 132, 497	18, 894, 530	5, 477, 153
1880	3, 602, 395	20, 013, 763	5, 531, 134
1881	2, 222, 845	16, 629, 412	5, 849, 474
1882	3, 792, 884	20, 441, 014	6, 722, 300

Batley, oats, buckwheat, and potatoes.

Years.	Barley.	Oats.	Buckwheat.	Potatoes.
	Bushels.	*Bushels.*	*Bushels.*	*Bushels.*
1874	12, 511, 014	30, 566, 498	8, 404	47, 758, 917
1875	15, 085, 793	44, 753, 032	12, 896	52, 057, 921
1876	13, 724, 726	41, 379, 594	12, 807	53, 458, 430
1877	11, 745, 016	43, 138, 526	9, 443	45, 706, 646
1878	15, 146, 245	49, 844, 051	12, 896	50, 494, 284
1879	14, 537, 465	48, 041, 864	25, 708	37, 221, 759
1880	15, 216, 396	49, 282, 130	26, 017	56, 622, 699
1881	14, 592, 662	52, 817, 701	10, 341	55, 661, 954
1882	17, 290, 595	61, 289, 350	10, 154	38, 809, 293

JAPANESE STATISTICS.

Return of agricultural products of Japan during three years ending in 1881:

Years.	Rice.	Glutinous rice.	Barley.	Wheat.
	*Koku.**	*Koku.*	*Koku.*	*Koku.*
1879	29, 053, 181	2, 635, 045	4, 952, 835	1, 926, 309
1880	28, 767, 728	2, 666, 011	5, 839, 255	2, 268, 602
1881	27, 414, 483	2, 497, 205	5, 247, 676	2, 043, 141

Years.	Rye.	Millet.	Beans.	Buckwheat.
	Koku.	*Koku.*	*Koku.*	*Koku.*
1879	3, 011, 767	1, 840, 710	2, 238, 959	684, 921
1880	4, 120, 459	1, 748, 804	2, 335, 783	698, 951
1881	3, 273, 063	1, 562, 174	2, 175, 337	697, 345

Years.	Cotton.	Hemp.	Cocoons.	Silk.
	Kiu.†	*Kin.*	*Kiu.*	*Kiu.*
1879	131, 430, 361	10, 611, 576	19, 787, 632	2, 813, 380
1880	8, 914, 027	9, 799, 207	23, 849, 790	3, 331, 044
	Kwamme.	*Kwamme.*		
1881	14, 481, 465	1, 919, 295	27, 214, 399	2, 881, 854

Years.	Tea.	Tobacco.
	Kiu.	*Kiu.*
1879	16, 642, 182	29, 986, 057
1880	2, 039, 756	28, 930, 319
	Kwamme.	*Kwamme.*
1881	5, 601, 159	4, 342, 253

Return of sakë brewed and rice used for brewing from October, 1879, to September, 1880:

	Amount of sakë brewed.	Amount of rice used for brewing.	Number of brewers.
	Koku.	*Koku.*	
Seishu	5, 015, 227	4, 751, 031	26, 889
Dokushu	65, 447	48, 632	4, 528
Shochiu	83, 738	50, 680	6, 905
Shirozake	1, 498	1, 253	216
Miriu	38, 581	30, 484	1, 011
Meishu	3, 616	1, 946	316
Total	5, 208, 107	4, 884, 026	39, 865

* A measure equal to 5$\frac{13}{100}$ English bushels.
† Equivalent to 1$\frac{1}{3}$ pounds avoirdupois.

Return of salt manufactures (exclusive of those of Awomori, Okinawa, and Hokkaido) for three years ending in 1881:

Years.	Koku.
1879	4, 848, 199
1880	6, 171, 283
1881	4, 945, 775

Return of vehicles:

Years.	Carriages.	Jinrikisha.	Carts.
1879	1,093	146,478	22,350
1880	1,316	157,018	27,803

Return of ships of foreign form of construction:

Years.	Steamers.	Sailing vessels.
1873	110	36
1877	183	75
1879	163	168

Return of hospitals in June, 1881:

Government hospitals	3
Branches	19
Public hospitals	192
Branches	40
Private hospitals	202
Branches	11

Return of fishermen and marine products, exclusive of Hokkaido:

Fishermen's families	341,370
Number of fishermen	1,530,795
Number of nets	436,912
Number of fishing boats	187,220

Marine produce:

Years.	Dried fish.	Katsubushi.	Dried sardines.	Dried awabi.
	Kiu.	*Kiu.*	*Kiu.*	*Kiu.*
1879	13,472,415	4,713,868	32,404,910	....
1880	11,139,438	3,689,650	99,176,062	616,919
1881	22,366,719	3,677,248	68,247,154	370,769

1883—THE CROPS OF THE YEAR.

The year has been favorable to the growth of those crops which do not require a high temperature. Potatoes, all roots, and oats have grown with unusual luxuriance, and yielded abundantly. The product of oats is further increased by sowings upon areas of winter-killed wheat that had been plowed up. The wheat yield was reduced below an average by the effects of alternate freezing and thawing, and the average rate of yield would have been still lower but for the substitution of spring crops for the areas most injured. The reduction in temperature in the central corn-growing districts, and the drought in the southern belt of States, were unfavorable to large production of corn, and the yield of cotton was reduced by the unequal distribution of spring and summer rains.

The temperature of May was below an average in all the cultivable areas of the country except in the Middle Atlantic States. In New England the mean temperature approached closely an average. In the cotton States the depression was from 1° to 3°, in the Ohio Valley nearly 4°, fully 5° in the Upper Lake region, and in the Missouri Valley nearly 7° below the average of several years. This was discouraging to planters, especially from the fact that April had been somewhat milder than usual in nearly all the agricultural districts.

June was more favorable to farm work, and to the germination and growth of crops already planted. In the northern tier of States much corn was planted in this month. On the Atlantic coast the range of the thermometer was a little above the average, in New England more than 2° above, but in the interior areas, from the lakes to the Gulf of Mexico, the readings were lower by about one degree. In the Upper Mississippi Valley, and in the Missouri Valley, the depression was greater. A higher than average temperature prevailed on the Pacific coast.

In July, the month for a vigorous start in corn-growth, the mean temperature was somewhat more than 2° below the average temperature of a series of years in the West, nearly the mean in New England, and above by about 1° on the Atlantic coast.

The depression was more general and injurious in August: 1° below the average on the Gulf, 2° in Tennessee, and from 3° to 4° in the Western States. September witnessed a continuance of general low temperature, and October presented a record little better, except as to the Atlantic coast and Gulf States. The record of temperature from Signal Service observations is as follows:

Districts.	April.		May.		June.		July.		August.		September.		October.	
	Average.	1883.	Average.	1883.	Average.	1883.	Average.	1883.	Average.	1883.	Average.	1883.	Average.	1883.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°
New England	43.2	43.5	55.1	54.8	64.4	66.7	69.8	69.0	69.5	68.1	62.2	59.8	52.8	49.2
Middle Atlantic States	50.6	50.1	61.4	61.5	70.5	71.7	75.6	75.3	73.8	72.3	68.2	65.8	58.2	57.0
South Atlantic States	62.0	61.7	70.0	68.9	77.8	78.2	80.4	81.5	79.3	78.2	74.3	72.8	65.0	66.9
Florida Peninsula	72.4	74.2	77.0	76.0	81.7	82.3	83.0	84.2	82.2	82.9	80.1	79.7	73.9	76.7
Eastern Gulf	65.5	66.3	73.3	70.6	79.4	79.0	81.2	81.8	79.6	79.5	74.8	75.2	65.6	69.7
Western Gulf	66.9	67.4	74.4	72.3	80.5	80.4	82.7	82.1	81.6	81.1	76.0	75.4	67.3	70.9
Rio Grande Valley	72.8	73.1	77.7	78.8	.....	.....	.....	.....	.....	.....	80.5	78.8	73.6	78.8
Tennessee	59.6	60.9	69.6	66.2	76.3	76.0	79.4	78.1	77.2	74.6	70.1	69.7	60.8	63.7
Ohio Valley	53.7	54.4	65.9	62.1	73.4	72.5	77.8	75.4	75.9	72.1	67.7	65.8	57.4	57.0
Lower Lakes	42.9	41.6	56.2	51.6	65.3	64.7	70.9	68.4	70.1	66.5	62.7	58.2	48.2	45.6
Upper Lakes	39.5	40.1	52.6	47.5	61.9	60.8	68.5	65.9	67.3	63.5	59.0	55.3	51.7	49.3

Districts.	April.		May.		June.		July.		August.		September.		October.	
	Average.	1883.	Average.	1883.	Average.	1883.	Average.	1883.	Average.	1883.	Average.	1883.	Average.	1883.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°
Extreme Northwest	37.3	38.5	54.1	47.6	61.6	62.4	68.7	65.5	66.3	62.7	54.7	53.7	42.7	40.1
Upper Mississippi Valley	50.9	52.3	63.9	57.8	71.6	69.3	76.1	74.1	74.6	70.2	64.8	61.6	54.1	51.1
Missouri Valley	48.2	50.8	62.4	55.5	72.0	68.3	76.0	73.7	75.1	70.9	63.6	60.4	51.5	47.8
Northern Slope	43.5	43.4	53.9	49.2	63.0	61.9	69.1	66.9	69.0	66.7	56.7	56.4	44.6	41.0
Middle Slope	51.0	50.7	60.6	58.5	72.3	69.0	73.7	73.6	72.5	72.9	63.9	63.9	53.6	51.0
Southern Slope	64.8	62.2	73.4	73.0	78.4	78.6	81.5	80.0	79.6	80.2	.....	.....	.....	.....
Northern Plateau	48.3	45.5	54.9	55.0	.....	.....	70.2	72.6	.....	.....	59.8	59.8	48.4	46.8
Middle Plateau	48.5	43.9	57.0	55.0										
Southern Plateau	59.4	56.3	68.6	65.2	78.0	78.9	82.0	80.0	78.5	78.3	72.2	72.4	61.3	58.0
North Pacific	50.2	48.2	54.9	55.8	62.0	63.6	66.7	66.9	64.4	62.4	58.9	59.4	50.7	49.8
Middle Pacific	57.7	54.9	62.6	61.2	68.7	70.9	71.2	72.3	70.5	69.7	68.0	69.7	59.2	57.7
South Pacific	61.7	59.6	67.2	65.5	72.4	74.2	80.0	80.9	80.6	79.9	72.8	75.8	66.1	63.1
Mount Washington, N. H.	20.6	20.0	33.5	34.0	43.4	46.6	48.0	46.4	47.5	43.8	40.9	38.9	30.6	29.3
Pike's Peak, Colo	13.1	12.1	22.5	19.5	33.3	31.3	40.4	39.1	39.0	38.8	31.3	30.2	21.5	16.4
Salt Lake City, Utah	.....	.....	.....	.....	68.7	70.5	76.4	75.9	74.4	76.4	64.4	69.3	52.2	46.1

The principal districts of the South and West brought into juxta position make a showing as follows:

Months.	South Atlantic.		Western Gulf.		Ohio Valley.		Missouri Valley.		Extreme Northwest.	
April	62.0	61.7	66.9	67.4	53.7	54.4	48.2	50.8	37.3	38.5
May	70.0	68.9	74.4	72.3	65.9	62.1	62.4	55.5	54.1	47.6
June	77.8	78.2	80.5	80.4	73.4	72.5	72.0	68.3	61.6	62.4
July	80.4	81.5	82.7	82.1	77.8	75.4	76.0	73.7	68.7	65.5
August	79.3	78.2	81.6	81.1	75.9	72.1	75.1	79.0	66.3	62.7
September	74.3	72.8	76.0	75.4	67.7	65.8	63.6	60.4	54.7	53.7
October	65.0	66.9	67.3	70.9	57.4	57.0	51.5	47.8	42.7	40.1
Average	72.7	72.6	75.6	75.7	67.4	65.6	64.1	61.1	55.1	52.9

Taking a rough average for the season by dividing the aggregate for the number of months, we find a medium temperature in the South nearly two degrees lower than usual in the Ohio Valley, three degrees lower in the Missouri Valley, and a little more than two in the extreme Northwest. This is less than has been popularly represented, and shows the tendency to exaggeration of unfavorable conditions. But for the occurrence of frost, by an extreme depression early in September, the temperature of the season would be recorded only a little less favorable to production of corn than an average year.

Inequality in the distribution of rainfall has had an injurious effect upon production. In New England there was an excess of percipitation in May, and a deficiency in June, and again a large excess in July and drought in August. In the Middle States there was a surplus in April and June, and a deficiency in May, July, and August. The South had too much rain in April, a deficiency in May, excess again in June, and drought in July and August, while in September the South Atlantic States had abundance, and the Gulf States a deficiency, and in October the status was exactly reversed.

The Ohio Valley was comparatively dry in April, wet in May, and wet again in June. The Missouri Valley had abundant rain through the season, giving corn an early start and uninterrupted growth through the season, though a higher temperature would have been more propitious in the higher areas.

CORN.

The rainfall of spring and early summer was unfavorable for corn-planting, and for germination when planted. Much of the late crop was

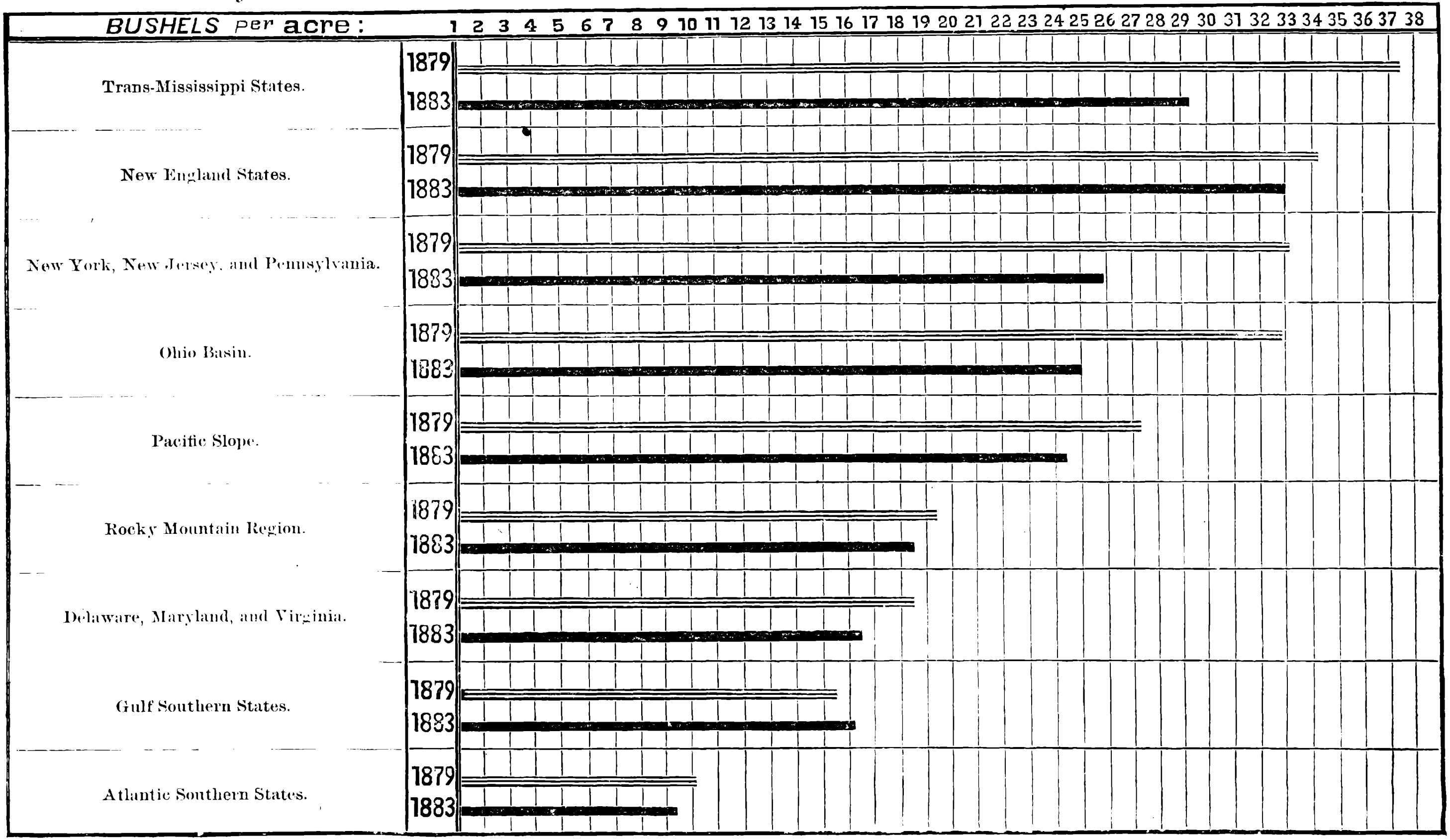
not sufficiently matured for seed, and this fact increased the area of replanting. On the other hand, the winter-killing of extensive areas of wheat rendered necessary a replanting in some spring grain. From this cause some extension of the breadth in maize is due in several States of the West. The area was increased about two and a half million acres. The proportion of advance is large in the Northwest and Southwest. On the Atlantic coast the enlargement of the breadth in cultivation was small. There was an excess of early rain in the great maize-growing districts of the West, and failure of stands from planting poor seed. Late in June, with better weather and the commencement of cultivation, growth became more rapid, and a more hopeful feeling began to prevail. In July the condition of the crop generally was under average, not essentially different from the July condition of the two preceding crops, but much worse than the status of corn in July of 1880, the last of a series of six large crops. During July there was a slight improvement of condition, giving promise of the best results of the last three seasons. This improvement extended through all districts except the extreme South; there the lack of seasonable rains was threatening some reduction of yield. A minor exception in the lake district might be noted as to Michigan, from excess of moisture and low temperature. It was remarked in the August report that the crop was late and that the nights had been too cool for the best growth. It was said, "fears are expressed that frost may yet cause disaster." The fulfillment of that prophecy was recorded in the next report. Prospects on the first of September were nearly as in August, contingent upon escape from frost, which came on the 8th and 9th of September, when an investigation by telegraph disclosed the fact of serious injury to the quality of corn not fully mature, and irreparable damage to that which could at best be fit only for immediate use. One feature of corn-growing in 1883 should prove a lesson to the farmers of the country. The general use of seed-corn in the West, grown in lower latitudes, the planting of Nebraska seed in Minnesota, of Kansas seed in Illinois, has demonstrated the folly of attempting to acclimate Southern maize in more northern districts. Much of the loss from the frost would have been avoided had seed been carefully selected from the best corn grown in the immediate neighborhood.

The lateness of corn from southern seed was the general remark of our correspondents. It was said in the September report that "where Kansas and Missouri seed had been planted in more northern territory, the crop is still later, causing much apprehension as to ripening." The prospect was thus stated:

On the 1st of September the prospect was as good as in September of last year, except that the probabilities of injury from frost were somewhat greater, the present crop being less mature. It warranted an expectation of five-sixths of a full crop, *i. e.*, one produced from a full stand, with vitality unimpaired by frost, flood, hail, drought or insects, and a medium growth. There is always some injury from one or more of these causes, so that 100 would never be quite attained, except by excess of growth above a medium. This standard is therefore equivalent to a crop representing the full capacity of the soil under the existing state of cultivation in an average year, with favorable meteorological conditions and absence of unusual insect injuries. For corn, as at present distributed geographically, 29 bushels per acre will nearly represent this standard for the entire country, though the standard of different States varies immensely. The average yield for a series of years will, of course, be less, and in recent periods has been fully ten per cent. less, the average yield for ten years being 26 bushels per acre. Seldom does the yield average 30 bushels, and not often does it fall below 23—in ten years past only twice, to 20.7 bushels in 1874, and 18.6 in the very disastrous failure of 1881.

The average condition of corn, through the growing season, during three summers, as reported on the first of each month, shows that at no period in the growth of these crops has an average product been in-

I.—*Diagram showing the yield per acre of corn, in 1879 and 1883, respectively, by groups of States.*

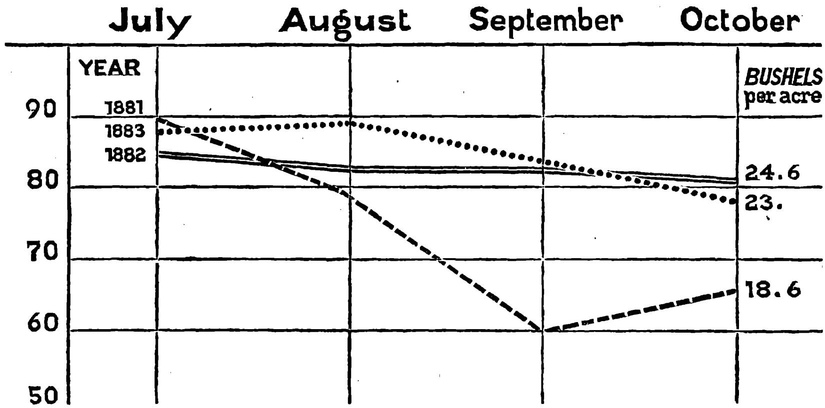


dicated—at no time has there been a prospect of a yield per acre as good as that of any of the years from 1875 to 1880. These averages of condition are as follows:

Months.	1881.	1882.	1883.
July	90	85	88
August	79	83	89
September	60	83	84
October	66	81	78

The following diagram makes comparison easy, and shows that the prospect of a crop during July and August was as good as in 1882, and far better than in 1881. The difference is this: the growth of the plant and development of ears was greatly superior in 1883, but the season in September and October was better in 1881 for hardening the smaller quantity produced; in 1883 there is a larger quantity and a larger proportion of soft corn.

The average yield per acre for the present year is nearly 23 bushels—more exactly, by the preliminary estimates following, 22.7—which is 12 per cent. less than an average yield for a series of years. This stands for the quantity of the present crop. Quality is another consideration.



If soft corn is cribbed in masses, and after a few weeks of mild and moist weather is badly injured, or even spoiled, it does not change the fact that the corn was grown and harvested. It is doubtless true that the quality of corn north of the parallel of 40° is worse than for many years, increasing practically the amount of shortage indicated by the number of bushels. The whole of the corn grown in 1883 in Michigan, Wisconsin, Minnesota, and Dakota, added to half of that grown in Ohio, Indiana, Illinois, Iowa, and Nebraska, would make an aggregate equal to a fourth of the whole crop; therefore a possible depreciation of forty per cent. in all of it would be equivalent to a ten per cent. reduction in the value of the entire crop. Our Illinois agent, Col. S. D. Fisher, makes the quality 31 per cent.; less than an average in that State.

An effort will be made later, after the worst of the crop has been fed, to test the feeding value of the year's product. It is not proposed, however, to reduce the product to an equivalent of "merchantable" corn, or "sound" corn, as no crop ever is free from immaturity and imperfection. There are always some northern fields caught by frosts, some neglected acres, some choked with weeds or flooded by overflows, and some sod corn that is mainly "nubbins." What is intended, without reference to panic or exaggeration of impressible minds, or sensa-

tional natures, is to find the exact truth, and then tell it. There is nothing gained, either to farmers or consumers, in suppressing the truth on the one hand, or exaggerating losses on the other.

The estimates will be found to agree substantially with those of State official systems, whose executive officers are also our agents, except as to acreage. The State assessors' returns have ever been too low, from incompleteness of returns, and cannot be accepted as a basis for the areas reported by this Department. The difference ranges from eight to fifteen per cent. It was mainly from accepting as a basis these annual returns by the predecessor of the present Statistician that caused discrepancies in acreage between his estimates and the returns of the census. From this cause, and not from difference in yield per acre, these estimates are somewhat higher than those of Ohio, Michigan, Illinois, and other States.

Preliminary estimate of the corn crop of 1883.

States and Territories.	Acres.	Yield per acre.	Bushels.
		Bushels.	
Maine	30, 367	35	1, 062, 800
New Hampshire	38, 014	36	1, 368, 500
Vermont	58, 623	31	1, 817, 300
Massachusetts	58, 262	35	2, 039, 100
Rhode Island	12, 947	32	414, 300
Connecticut	57, 001	30	1, 710, 000
New York	761, 423	23	17, 512, 700
New Jersey	346, 971	28	9, 715, 100
Pennsylvania	1, 402, 127	27	37, 857, 400
Delaware	212, 346	18	3, 822, 200
Maryland	691, 542	23. 5	16, 251, 200
Virginia	1, 919, 199	14	26, 868, 700
North Carolina	2, 494, 977	11. 5	28, 692, 200
South Carolina	1, 388, 481	8	11, 107, 800
Georgia	2, 829, 415	8. 7	24, 615, 900
Florida	399, 914	8. 5	3, 399, 200
Alabama	2, 277, 338	11. 5	26, 189, 300
Mississippi	1, 870, 902	13. 5	25, 257, 100
Louisiana	924, 693	14. 2	13, 130, 600
Texas	3, 608, 362	17. 5	63, 146, 300
Arkansas	1, 740, 372	17. 5	30, 456 500
Tennessee	3, 212, 952	20	64, 259, 000
West Virginia	588, 233	24. 3	14, 294, 000
Kentucky	3, 258, 410	24	78, 201, 800
Ohio	2, 818, 480	26. 1	73, 560, 000
Michigan	911, 165	23. 5	21, 412, 300
Indiana	3, 541, 482	27	95, 620, 000
Illinois	8, 151, 463	25	203, 786, 500
Wisconsin	1, 122, 826	21	23, 579, 300
Minnesota	727, 155	20. 8	15, 124, 800
Iowa	6, 980, 621	24. 3	169, 629, 000
Missouri	5, 878, 364	27. 5	161, 655, 000
Kansas	4, 708, 473	36. 7	172, 800, 900
Nebraska	2, 813, 303	36	101, 278, 900
California	100, 607	24. 5	2, 464, 800
Oregon	5, 504	23. 5	129, 300
Nevada	847	25	21, 100
Colorado	21, 287	25	532, 100
Arizona	2, 736	20	54. 700
Dakota	270, 058	18. 2	4, 915, 055
Idaho	1, 627	20	32, 500
Montana	502	20	10, 040
New Mexico	46, 506	20	930, 100
Utah	13, 340	21	280, 100
Washington	2, 672	23	61, 400
Total	68, 301, 889	22. 7	1, 551, 066, 835

WHEAT.

The condition of wheat in April was lower than for several years at that date. The poor crop of 1881 had a perceptibly better start in spring, having suffered somewhat less from the alternations of freezing and thawing. The fields of Ohio were stricken with greatest severity, and

those of Indiana and Illinois were only a little more promising. The whole area showed a depreciation of 20 per cent. from the standard of condition. The effect of frost was quite perceptible even in the South. The snow-fall in lower latitudes was unusual, and sleet and ice frequently reported. The report of May indicated a slight improvement. It also demonstrated the severity of local winter-killing, and attested the plowing up of large areas in Ohio, Indiana, and Illinois, and the substitution of oats or other spring crops. It became evident that a full crop was impossible, and an average yield improbable. May was generally unfavorable, and the returns of the first of June ranged lower than those of May. The growing weather of June developed a higher promise and dispelled in slight degree the previous forebodings of failure. Yet the improvement was not very great, the only report declaring: "Assurance is made very positively sure that there will be a shortage of 80,000,000 to 90,000,000 bushels in the winter-wheat crop, and a probable deficiency of 70,000,000 to 80,000,000 bushels in the aggregate wheat product of the year." There was no warrant in the returns for the commonly reported deficiency of 20 to 25 per cent. The depreciation was nearer one-sixth.

A false impression was made by the heavy deficiency of the Ohio basin, for which the high condition and large area in spring wheat made some compensation. The August report of spring wheat was favorable, with few exceptions, throughout the Northwest.

The result was a small reduction of area in wheat, and a yield per acre about a half bushel less than an average crop.

Preliminary estimate of the wheat crop of 1883.

States and Territories.	Acres.	Yield per acre.	Bushels.
		Bushels.	
Maine	43,263	14.2	614,300
New Hampshire	11,500	15.8	181,700
Vermont	21,573	16.4	353,700
Massachusetts	1,180	16.7	19,700
Rhode Island	.....	.....	.....
Connecticut	2,171	15.8	34,300
New York	780,124	10.3	8,035,200
New Jersey	154,000	13.4	2,063,600
Pennsylvania	1,518,474	13.2	20,043,800
Delaware	93,860	10.3	966,700
Maryland	626,200	12.1	7,577,000
Virginia	928,089	9.0	8,352,800
North Carolina	717,100	5.9	4,230,800
South Carolina	218,500	5.2	1,136,200
Georgia	504,900	5.1	2,574,900
Florida	.....	.....	.....
Alabama	276,450	5.2	1,437,500
Mississippi	49,500	5.0	247,500
Louisiana	.....	.....	.....
Texas	506,000	8.5	4,301,000
Arkansas	232,200	6.1	1,416,400
Tennessee	1,323,000	5.6	7,408,800
West Virginia	425,700	10.0	4,257,000
Kentucky	1,248,390	7.7	9,612,600
Ohio	2,588,400	10.0	25,884,000
Michigan	1,786,500	14.0	25,011,000
Indiana	2,735,370	10.4	28,447,800
Illinois	2,215,000	10.0	22,150,000
Wisconsin	1,593,900	12.3	19,604,900
Minnesota	2,597,940	13.0	33,773,200
Iowa	2,435,300	11.3	27,518,800
Missouri	2,358,350	10.1	23,819,300
Kansas	1,534,350	17.5	26,851,100
Nebraska	1,772,990	15.5	27,481,300
California	2,794,000	13.0	36,322,000
Oregon	795,300	16.5	13,122,400
Nevada	5,424	18.3	99,200
Colorado	114,000	21.0	2,394,000
Arizona	.....	.....	.....
Dakota	1,008,000	16.0	16,128,000
Idaho	.....	.....	.....

Preliminary estimate of the wheat crop of 1883.—Continued.

States and Territories.	Acres.	Yield per acre.	Bushels.
		Bushels.	
Montana	57,796	16.3	942,000
New Mexico	65,195	15.0	977,900
Utah	83,130	19.0	1,579,400
Washington	170,200	18.7	3,182,700
Total	36,393,319	11.5	420,154,500

OATS.

The season has been remarkably favorable for oats. The reported condition of the crop was high throughout the season. The general average of the season commenced with 96 and ended with 99. The Department report of condition when harvested in 1879 was 87, and the census average of yield was 25.3 bushels. The average of yield in the present crop is 28.1 The area has largely increased in four years, and especially by substitution for wheat this year, and the aggregate is made fully twenty million acres. There is a strong tendency to enlargement of breadth in oats throughout the Southern States, both for winter pasture and for the grain. It is found that moderate pasturage in winter is quite compatible with a good yield in spring. It is found also that a larger portion of oats in the ration of horses is essential to their highest health, as corn is too heating for exclusive summer feed. The estimates of the crop by States, is as follows:

Preliminary estimates of the oats crop of 1883.

States and Territories.	Acres.	Yield per acre.	Bushels.
		Bushels.	
Maine	84,579	31.5	2,665,000
New Hampshire	29,697	34.8	1,033,000
Vermont	102,505	34.6	3,548,600
Massachusetts	23,098	31.3	724,000
Rhode Island	5,882	30.4	179,100
Connecticut	37,141	29.6	1,100,700
New York	1,344,637	31.3	42,071,400
New Jersey	130,873	32.6	4,265,800
Pennsylvania	1,247,868	30.6	38,193,200
Delaware	21,664	23.9	517,600
Maryland	100,323	20.2	2,023,800
Virginia	628,434	10.0	6,275,600
North Carolina	593,890	8.7	5,142,000
South Carolina	362,805	9.8	3,544,000
Georgia	780,682	9.0	7,018,700
Florida	51,528	9.8	504,500
Alabama	427,199	10.6	4,517,300
Mississippi	274,236	11.5	3,142,400
Louisiana	34,096	13.9	475,000
Texas	416,096	22.8	9,489,300
Arkansas	223,961	14.4	3,225,400
Tennessee	586,490	11.9	6,997,700
West Virginia	129,829	15.6	2,020,300
Kentucky	422,628	16.3	6,899,900
Ohio	871,250	33.9	29,560,000
Michigan	580,451	34.6	20,061,300
Indiana	717,560	29.7	21,304,100
Illinois	2,848,555	36.1	102,780,000
Wisconsin	1,331,392	30.4	40,502,700
Minnesota	949,200	33.1	31,447,500
Iowa	2,005,569	34.1	68,403,600
Missouri	1,057,422	28.7	30,374,200
Kansas	699,476	39.4	27,560,000
Nebraska	540,161	40.0	21,630,000
California	70,858	25.8	1,826,600

Preliminary estimates of the oats crop of 1883—Continued.

States and Territories.	Acres.	Yield per acre.	Bushels.
		Bushels	
Oregon	170, 993	24. 6	4, 211, 800
Nevada	7, 344	28. 9	212, 100
Colorado	41, 250	29. 3	1, 209, 000
Arizona			
Dakota	210, 000	42. 9	9, 000, 000
Idaho	30, 450	37. 4	1, 140, 000
Montana	32, 200	37. 6	1, 210, 000
New Mexico	11, 760	17. 0	199, 800
Utah	24, 050	22. 7	546, 000
Washington	62, 540	39. 7	2, 480, 400
Total	20, 322, 622	28. 1	571, 233, 400

COTTON.

The cotton area of the present year was planted somewhat later than usual. The prevalence of cold rains delayed the work in the northern belt. On the 1st of May, when five-sixths of the breadth should be in, scarcely three-fourths of it was planted. In Virginia and North Carolina much the largest portion was planted in May.

The June returns indicated an increase of 3 per cent. in the acreage. The largest increase was 8 per cent. in Texas, and nearly all of it in the Mississippi Valley. The record is as follows:

States.	1882.	Per cent.	1883.
	Acres.		*Acres.*
Virginia	61, 985	90	55, 786
North Carolina	1, 050, 543	100	1, 050, 543
South Carolina	1, 587, 244	102	1, 618, 989
Georgia	2, 844, 305	101	2, 872, 748
Florida	260, 402	99	257, 799
Alabama	2, 534, 388	103	2, 610, 420
Mississippi	2, 233, 844	102	2, 278, 521
Louisiana	887, 524	105	931, 900
Texas	2, 810, 113	108	2, 034, 922
Arkansas	1, 110, 790	107	1, 188, 545
Tennessee	815, 760	99	807, 602
Missouri, Indian Territory, and other States	79, 793	88	70, 218
Total	16, 276, 691	103	16, 777, 993

The plants were everywhere reported late on the 1st of June, from one to three weeks. There were counties in North Carolina in which only one-sixth to one-third of the plants were visible. Frosts on the 23d of May were injurious throughout the northern counties. In South Carolina cold nights and drying winds during May greatly reduced vitality, and the weather of the 1st of June was scarcely warm enough for cotton. Similar causes produced like effects in Georgia, somewhat modified by milder temperature. One correspondent claimed from personal record the worst season for cotton in twenty-seven years. Notwithstanding these discouragements a fair stand was reported, medium vitality, and generally clean cultivation. The average of condition was but little lower than that of the previous year at the same date. There was nothing, so far, to make absolutely impossible a crop of seven million bales.

It was found on the 1st of July that condition had improved, reducing slightly the small difference between the present and the past season. In many districts excess of moisture had prevented cultivation,

so that clean fields were found only in favored districts and on lands of prompt and pushing cultivators.

The caterpillar made its appearance on the 14th of May in Butler County, Alabama, twenty days earlier than ever known before. Counties in Texas reported the presence of the caterpillar also in May. The caterpillar was reported in Florida in July, and in August its presence began to assume threatening proportions in the Gulf Coast States. They were most numerous in Central Alabama, abundant locally in Texas, and troublesome in Louisiana, Mississippi, Georgia, and Florida. The use of arsenic in various forms consumed tons of that poison, with much effect in averting threatened losses. The boll-worm was reported only at a few points, mainly in Texas and Arkansas. The ultimate losses from insect depredations were not so heavy as in many former visitations.

It became apparent in August that the crop would be less fruitful than had been hoped. The plant had suffered from the meteorological vagaries of a peculiar season. It had been too cold in May, too wet in June, and too dry in July. Local peculiarities of temperature and rainfall were developed. The prolific cotton-belt of Central Alabama had suffered severely from drought, while the valley of the Tennessee had enjoyed seasonable weather. The best districts of Georgia were withered with drought, while the usually dry fields of Central and Southern Texas showed far less injury from this cause. At the same time rains were generally seasonable and sufficient in Louisiana, Tennessee, and North Carolina. During August the effect of drought became very general, Florida and Tennessee constituting the exceptions; yet there were some local rains, producing great variety in the reports of the several counties.

Reports of October 1st were somewhat gloomy, but frosts were delayed and the weather fine for opening and picking during that month, until a more hopeful feeling prevailed, and the November indications pointed to 86 per cent. of the crop of the previous year. The December returns were not less favorable, fully confirming the expectation of a crop of about six million bales—a result exceeded but twice in the history of the cotton crop. But the area is large and the yield per acre will be scarcely a medium one.

The following statement applies the percentages of product by States, as given in the December returns, to the figures of the previous crop:

States.	Estimated product, 1882.	Per cent.	December returns, 1883.
	Bales.		*Bales.*
Virginia	24, 000	75. 0	18, 000
North Carolina	463, 000	87. 0	402, 810
South Carolina	630, 000	76. 0	478, 800
Georgia	942, 000	82. 0	772, 440
Florida	62, 000	95. 0	58, [illegible]00
Alabama	810, 000	84. 0	680, 400
Mississippi	1, 064, 000	88. 0	936, 320
Louisiana	560, 000	92. 0	515, 200
Texas	1, 326, 000	90. 0	1, 193, 400
Arkansas	697, 000	83. 0	578, 510
Tennessee	337, 000	102. 0	343, 740
Missouri and Indian Territory	42, 000	85. 0	35, 700
Total	6, 957, 000	86. 4	6, 014, 220

There will be another investigation after the close of the picking season and the shipment of a large portion of the crop, when the precise results of the harvest may possibly be approached more nearly than has been possible hitherto.

ORGANIZATION AND WORK.

The Division of Statistics has a section of Correspondence and Investigation, a section of Crop Returns and Records, and a section of Railway and Steamship Transportation Rates. The crop-reporting system includes a corps of about eight thousand correspondents reporting from more than two thousand producing counties. A parallel and supplementary work is carried on through statistical agents representing each State and Territory. These agents are executive officers of State official systems of crop-reporting in the States where such work is organized, thus combining State and National organizations, and unifying and perfecting the work. It is extremely important that the States not yet represented by such organizations should promptly join the list of those progressive and advanced States now engaged in statistical work.

The inauguration of crop-reporting work in Europe, for the information of American farmers who depend more or less upon the European demand for their cereal and meat products, has been attended with a good degree of success, as an initiatory work, under the direction of our agent in London, Mr. Edmund J. Moffat.

In the work of the year, for the annual and special reports, statements for the use of Congress and other Departments, for commercial boards, and writers for the press and others, the general assiduity and accuracy of the Division clerical corps is cheerfully commended.

J. R. DODGE,
Statistician.

Hon. GEO. B. LORING,
Commissioner of Agriculture.

EXPERIMENTS WITH SORGHUM CANE, 1883.

SIR: I have the honor to submit the following summary of the general results obtained by this division in the experiments with *Sorghum saccharatum* during the present season. The detailed report of these experiments I will submit at a later date for special publication.

AMBER CANE GROWN ON PATTERSON FARM, NORTHEAST OF WASHINGTON.

The land is a stiff clay, with some gravel on the high ground. The exposure is toward the southwest. The south half of the field is gently rolling, while the north half is hilly.

The soil was plowed and subsoiled and the cane planted at intervals during the month of May. About 300 pounds of superphosphate were drilled in at the time of planting. The cane received the usual cultivation. On September 10 I found the greater number of seed-heads of the Early Amber cane ripe and the seed quite hard.

A few of these canes were cut, the juice expressed and analyzed. The result of the analysis showed a percentage of 9.17 sucrose and 4.83 of other sugars.

In spite of this discouraging outlook, I determined to begin operations at the mill in order that the experimental season might be as long as possible.

A few tons of cane were brought in on the 11th of September, and on the morning of the 12th I began milling.

METHOD OF OPERATIONS.

In order that the analyses might represent the average composition of the canes, the samples of juice were taken directly from the receiving-tank when it was full. I was convinced that however interesting and valuable from a scientific point of view the analyses of selected canes might be, yet they could never give to the farmer and manufacturer data upon which it would be safe to base the results of large field and mill operations. I therefore considered it to be of first importance that the analytical work should represent precisely the character of the operations taking place at the mill.

WEIGHT OF CANE.

The canes unstripped were brought from the fields after the seed-head, with a part of the stalk averaging about 15 inches in length, had been cut off.

Each load was weighed, and in the calculations for net weight 10 per cent. was deducted for the weight of the blades. Experiments of former years had shown that this was the proper correction to make. The total gross weight of Amber cane brought to the mill was 746,350 pounds.

WEIGHT OF JUICE.

The defecating-tanks receiving the juice were two in number. In all, sixty defecations were made in the large tank and five in the small one.

The average quantity of juice received in large tank was 548 gallons, which, multiplied by 60=32,880 gallons. The average quantity of juice received in small tank was 301 gallons, which, multiplied by 5=1,505 gallons. In addition to this must be reckoned juice used for fermentation and other experiments, which may be estimated at 1,000 gallons. The total number of gallons of juice expressed, therefore, from the Early Amber cane is 35,385. The average specific gravity of this mill juice was 1.06, and the weight of one gallon 8.84 pounds. The total weight of juice expressed was $35,385 \times 8.84 = 312,803$ pounds. The percentage of juice to gross weight of cane was 41.9. The percentage of juice to net weight of cane was $312,803 \div 671,715 = 46.60$.

A POOR YIELD.

The yield of juice was remarkably poor. This was due to two causes, viz: (1) The cane was crooked, broken, and tangled so that it was almost impossible to get an even feed; and (2) the mill, built on the model of mills designed for tropical cane, was not suited to grinding the weak and yielding stalks of sorghum.

The mill was constantly choking, the canes, after passing the first rolls, becoming tangled in the "knife" and forming into a wad that would not pass the second rolls.

In order to make the mill work it became necessary to loosen the third roll somewhat, and this allowed the canes to pass without sufficient pressure.

WEIGHT OF BAGASSE.

A few experiments were made to determine the percentage of juice expressed by weighing the bagasse.

On September 14, 6,700 pounds cane gave 2,730 pounds of bagasse and 3,970 pounds of juice=59.2 per cent.

On September 27, after the rolls had been opened to allow more rapid work, 3,420 pounds cane gave 1,660 pounds of juice=47.9 per cent.

On October 1, 2,160 pounds cane gave 970 pounds of juice=40.3 per cent.

On October 3, 2,360 pounds cane gave 1,200 pounds juice=50.8 per cent.

On October 5, 2,020 pounds cane gave 940 pounds juice=46.5 per cent.

Since all the juice expressed was measured, I did not think it necessary to continue these weights. Those that are given, however, only give additional emphasis to the results obtained by measuring the juice.

AVERAGE YIELD OF SINGLE MILLING.

With a three-roll mill, especially adapted to working sorghum, I think a yield of 55 to 60 per cent. in weight of juice is all that can be expected with unstripped canes. In 1882 the Lafayette Sugar Company, in fifteen weighings of cane and bagasse, showed a yield on cleaned cane of 65 per cent. But this is higher than can generally be expected. As a result of several years of observation and experience, I am convinced that the average yield of three-roll mills on unstripped cane of all kinds does not exceed 50 per cent., and often falls below that number. By double milling, with intervening steaming or moistening with hot water, much better results are obtained.

Unfortunately no exact data of the working of such mills are at hand, and I can but regard as extravagant the statements which have been made which claim a yield of 75 to 80 per cent. of the weight of the cane milled in juice. Experiments in this division have shown that sorghum cane contains of water and substances soluble therein about 88 per cent. of its weight.

A perfect extraction of the juice by milling, therefore, would give 88 pounds juice to each hundred pounds of cane. It is needless to add that no system of milling now in use comes near realizing this ideal yield.

PERCENTAGE SACCHARINE MATTER EXTRACTED.

The 671,715 pounds Early Amber cane contained 671,715×.88=591,109 pounds of juice. The quantity of juice obtained, however, was 312,803 pounds. The weight of juice left in bagasse was 591,109 pounds—312,803=278,306, or 41.4 per cent. of the weight of cane.

The great waste of saccharine matter, by the best systems of milling, is a point that will attract the attention of every one interested in the sorghum industry, and one which led me to make the experiments on diffusion described farther on.

CANE WORKED FOR SUGAR.

Of the total weight of 746,350 pounds, all but 174,000 pounds was worked for sugar. The quantity of juice boiled for sugar was 572,350×41.9=239,814 pounds. The percentage of sucrose in this juice determined by the mean of the analyses of each tank full was 8.77.

The sugars not sucrose (invert sugar, optically inactive sugar, and other substances reducing the alkaline copper tartrate), mean of all the analyses, was 4.00 per cent. Total sugars=12.77 per cent. Total solids=14.14 per cent. Solids not sugars=1.37 per cent. Coefficient of purity=62.

It will be of interest to compare these results with the analyses of ripe amber canes made in this division during the years 1882, '81, '80, and '79.

	Per cent.
For 1879 the average of sucrose (14th stage)* was	12.44
For 1879 the average of other sugars was	1.16
For 1880 the average of sucrose (1,127 analyses)† was	13.85
For 1880 the average of other sugars was	1.64
For 1881 the average of other sucrose (59 analyses) was	15.29
For 1881 the average of other sugars was	1.62
For 1882 the average of sucrose was	10.48
For 1882 the average of other sugars was	1.33
For 1883 the average of sucrose (137 analyses) was	8.77
For 1883 the average of other sugars was	4.00

The striking inferiority of the canes of this season is at once apparent. It appears to be due to the cold season, especially in August and September, and to the fact that the whole field was prostrated by the storm of September 12 and 13, as the canes never improved from that time.

To make crystallized sugar out of such an unpromising juice was an almost hopeless undertaking.

While I am sorry that the meager yield of sugar has been a disappointment, not only to you and the friends of the industry throughout the country, but also to this division, yet I do not see how, with the character of the cane, and the method employed, it could well have been greater.

MANUFACTURE.

The method of manufacture was an extremely simple one.

As the juice flowed from the mill bisulphite of lime solution was allowed to drop into it, about one quart to each 100 gallons of juice.

The object of adding the bisulphite of lime is to prevent fermentation. Raw sorghum juice, in a very short time after it is expressed, will begin to change unless some measures are taken to prevent it. Instead of the lime bisulphite the juice may be brought at once, on coming from the mill, into contact with sulphurous dioxide (sulphur fumes).

The bisulphite method has this advantage, viz, the quantity of sulphur introduced is under complete control, and can be varied to suit the quality of the juice at hand.

Arriving at the defecating-tank,‡ the juice was heated to about 60° to 70° C. (125° to 140° F.). The steam was then turned off and milk of lime (specific gravity, 15° B.) added, with constant stirring until litmus paper showed exact neutrality. The temperature was then rapidly raised to the boiling point, but the liquid was not allowed to boil. After five minutes the scum was removed and the liquid allowed to flow through bag filters into a receiving-tank below. Thence it was pumped into a large concentrator, and the steam turned on gently so that the foam would come nearly to the top of the pan. This foam was now swept off (into a gutter running around the pan) until it became perfectly white and clean.

* Ag. Rept., 1880, '81, p. 452.

† Ag. Rept., 1880, '81, p. 493.

‡ Dimensions of tank: Length, 59.5 inches; width, 42 inches; average depth of juice, 33 inches; heating surface, 79 feet 2 inches, copper pipe.

The steam was now turned off until the foam settled, and then turned on with a full head, so as to at once throw the whole mass into violent ebullition.

For this end the pressure of the steam ought not to be less than four atmospheres (60 pounds).

The boiling was continued until the sirup marked 20° B. while still hot. It was then dropped into a receiving-tank, whence it was sucked up into the vacuum pan and concentrated to 44° to 45° B.

With juice of this kind I found it impossible to "boil to grain," although many faithful attempts were made. It was not difficult to start the crystals, but with a sirup so poor in sucrose and so rich in other sugars it was quite impossible to nourish them. They all died of inanition before the concentration was complete.

When sufficiently concentrated the mass was dropped into wagons holding three hectoliters (85 gallons) and placed in the crystallizing room. This room was kept at a temperature of 40° C. (106° F.), and after five to ten days the crystallization was complete and the melada ready for the centrifugal.

The sugar made in this way, while of course raw, nevertheless had a nice yellow color and an agreeable flavor.

CANE WORKED FOR SIRUP.

The cane which was harvested from September 29 to October 3, inclusive, was so very poor in quality that no attempt was made to crystallize the juice.

The total weight of this cane was 174,000 pounds. Its content of sucrose was 6.73 per cent., and of other sugars 6.16 per cent.

	Per cent.
Total sugars	12.89
Total solids	13.64
Solids not sugar	.76
Coefficient of purity	50.00

Since long experience has shown that substances other than sucrose in solution prevent their equal weight of sucrose from crystallizing, it is apparent that in such a juice all hope of obtaining crystals must end in disappointment.

The quantity of sirup made from the 174,000 pounds cane was 1,104 gallons.. The weight per gallon was 11.5 pounds. Total weight sirup made, $1{,}104 \times 11.5 = 12{,}696$ pounds. Number of gallons of sirup per ton of cane, 12.7. The sirup is of fine flavor, but rather dark in color, owing to using lime to exact neutrality.

NOTES ON RESULTS OF WORK.

1. Single milling, *i. e.*, passing canes through one three-roll mill, gives so poor a yield that it will have to be abandoned for sorghum-working. Tropical canes seem to mill better than the stalks of sorghum, and single milling of such canes may continue to prove profitable. It is evident, however, to every practical worker that a system of expression which gives only 45 to 50 per cent. of the total juice of the cane is too wasteful to meet the continued approval of farmers and manufacturers.

Double milling is doing much to remove this difficulty. This division has made only a few experiments with double milling, and these show a yield of nearly 65 per cent. of weight of cane. In the establishments where this process has been used only estimates have been made of its

efficiency. These estimates, however, may be wide of the truth. I think, however, we may safely say that double milling increases the yield of juice 10 to 15 per cent.

2. The soil in the vicinity of Washington is not suitable to the growth of sorghum cane. It is true the yield of cane this season is far better than it has ever been heretofore since the Department undertook experiments with cane-raising in this locality. When, however, careful planting and cultivation and liberal fertilizing, combined with a fairly favorable season for growth, fail to produce ten tons of cane per acre, it must be admitted that there is a radical defect of soil. The climate of Washington, however, is peculiarly favorable to cane-growth. Early springs, warm summers, and late falls are all that the practical cane-grower could demand. A sandy loam appears to be the most favorable soil for cane. Yet, it should not be forgotten that sorghum is a hardy plant; it will grow even under the most unfavorable conditions, and rarely proves a complete failure.

3. Manufacturers and intending manufacturers should not base their calculations for the yield of sugar on working canes containing 12 per cent. sucrose and only 1.5 to 2 per cent. of other sugars. I doubt whether any field of sorghum of 10 acres extent has ever been raised which would give such an average result. In the present state of the industry it would be much safer to count on 9 per cent. sucrose, 3 per cent. other sugars, and 2 percent. solids not sugar, as an average of the crop from year to year. I think this division would be guilty of a great public wrong were it by any kind of select results or enthusiastic coloring to induce capitalists to invest money where they would be led to expect a higher return than the actual facts warranted.

The results of the analyses made this year, poor as they are compared with those of former years, may nevertheless prove of great advantage to those who are proposing to practically engage in the sorghum-sugar industry by causing them the more carefully to consider all the difficulties which they will have to meet.

AMBER CANE GROWN IN INDIANA.

In order to determine the influence of soil and climate on the sugar product of cane, the Lafayette Sugar Company, Wea, Ind., engaged to plant and cultivate five acres of Early Amber cane for the Department of Agriculture; to work the same to a semi-sirup weighing 25° B. hot; to put the same in barrels and send to Washington, to be boiled for sugar.

The soil in which the cane was grown was a light sandy loam, with gravel, then clay subsoil, and quite hilly. On the top of the hills the soil was full of gravel and quite unproductive. The field had been in cultivation fifteen years, mostly in corn, and had never had any fertilizer of any kind. The average yield of corn on the patch put in cane had been about 20 bushels per acre. The ground was plowed with a common two-horse plow, and harrowed. The cane-seed was drilled in rows 3½ feet apart on the 3d of May. The seed had been previously steeped in tepid water for forty-eight hours. The plants generally came up in a week. The young plants suffered much from cold, wet weather. The cane received two hoeings, and three plowings with double sulky cultivator. There was a heavy frost the morning o May 31, injuring the young plants somewhat.

Mr. Duning, the superintendent, writing under date of August 3, says:

The season has been remarkable for the number of heavy rainfalls accompanied with strong winds, damaging the cane considerbly. At 2 p. m. this day the thermometer registered 39°.

During the latter part of September I went to the company's works at Wea (West Point post-office), Ind., to superintend the working of this cane into semi-sirup, which was done on the 1st and 2d of October. The method employed was the same as has been described for the cane here, with the exception that the juice as it left the mill passed through a sulphur box where it was thoroughly mixed with the fumes of burning sulphur. This removed the necessity of allowing the lime bisulphite to run into the juice as it left the mill, and this chemical was therefore added first when the juice reached the defecator.

PRODUCT OF CANE, ETC.

A heavy rain and wind storm on the night of September 29 had completely prostrated the cane, and the whole of it was gathered and weighed very wet. I therefore make a deduction of 2½ per cent. for this increase of weight.

Tons wet cane	48
Less 2½ per cent	46.8
Tons clean cane	42
Gallons juice expressed	5,309
Specific gravity	7.95° B.
Temperature	68.8° F.
Weight of juice expressed	46,932 lbs.
Per cent. juice expressed (gross weight cane)	50
Per cent. juice expressed (net weight cane),	55.9

The mill used was Squier's No. 2, of Louisiana.

The semi-sirup made amounted to 1,014 gallons, measured cold; specific gravity, 27° B.=1.225. One gallon therefore weighs 10.17 pounds; total weight, 1,014 gallons=10,312 pounds.

This semi-sirup was put in barrels and sent to Washington by freight. It arrived here on October 25, and was immediately boiled in the vacuum-pan.

The crystals were easily started in the pan, and grew to full size in about ten hours.

The melada was ready for the centrifugal as it came from the pan, and some of it was swung directly from the pan, yielding 50 per cent. of good sugar.

I did not succeed in "boiling to grain" with any other sirup except these two "strikes" from the Indiana cane.

SUGAR OBTAINED.

The weight of sugar obtained from the Indiana cane was, of *firsts*, 2,860 pounds. This gives a percentage of 3.39 on cleaned cane ground, and 6.09 per cent. of the weight of juice expressed.

The result of the experiment with the Indiana cane was in every way encouraging, and served in a manner to diminish the disappointment which attended the work in other directions.

A yield of over 60 pounds of sugar to the ton when only 50 per cent. of the weight of cane was obtained in the expressed juice is an indication of what may be obtained in the future, with better milling or a more thorough extraction of the sugar by other methods.

ANALYSES OF CANES, SIRUPS, AND SUGARS FROM INDIANA CANES.

These canes were cut, the leaves and tops left undisturbed, the cut surfaces covered with melted wax, and the whole wrapped carefully in paper and sent by express to the laboratory here for analysis.

Nos. 1 and 2 were cut the afternoon of October 1 and analyzed October 4, having been three days on the road.

No. 1 was a sample of eight selected canes. No. 2 was a sample of sixteen canes taken *seriatim* from an average row, and represents the cane as a whole. It seems to have deteriorated very little in transit, and the analyses of the semi-sirup go to show that the average of the whole patch was about a mean of the results of Nos. 1 and 2.

No. 3 was cut at 4 p. m., October 1, and analyzed October 6, at 9 a. m., an interval of four days and seventeen hours. The results of this analysis show that the cane had greatly deteriorated.

From this it appears that canes even carefully prepared and protected will not keep in good condition longer than three days in warm autumn weather.

TABLE OF RESULTS.

Indiana canes and sirups.	Sucrose.	Other sugars.
	Per cent.	*Per cent.*
No. 1. Sample of eight selected canes	13.25	2.30 (juice.)
No. 2. Sample of sixteen average canes	10.73	3.71 (juice.)
No. 3. Cane cut October 1	8.54	5.99 (juice.)
No. 4. Semi-sirup	36.76	9.90 (semi-sirup.)
No. 5. Semi-sirup	37.27	10.02 (semi-sirup.)

SEMI-SIRUPS.

Nos. 4 and 5 of preceding table were taken from semi-sirups made October 1. The sirup was placed in glass-stoppered bottles, sealed with wax, and sent by express to Washington. The analyses were made October 8. It appears from the results of these analyses that sorghum juice can be boiled quickly in open pans to a density of 20° to 25° B. with very little loss of sugar.

The best method, however, would be to put the juice, as soon as it is completely clarified, into a triple effect vacuum-pan, reduce to 25° B., and thence to strike-pan, where the evaporation is completed.

REMARKS—SEMI-SIRUP.

The semi-sirup from the Indiana cane acquired a somewhat darker color by remaining three weeks in barrels than it had at first. It did not, however, suffer any deterioration in its sugar content, and made as much sugar doubtless as it would have done if boiled directly to grain from the concentrating pans.

This fact is one which may prove of some importance to manufacturers whose strike-pans are inadequate to the capacity of the rest of the works.

My experience confirms that of Professors Weber and Scovell, who last year stored semi-sirup at their works at Champaign, Ill., with success. In such cases, however, it is necessary to be constantly on the alert to guard against every appearance of fermentation. A fermentation once started in a quantity of semi-sirup would act like a contagiuos disease, and soon affect every fermentable liquid within its reach Only necessity, therefore, should lead to the storage of semi-sirup. It should be reduced to melada as soon as possible.

SUGAR.

The sugar made from the Indiana cane was of a light-yellow color, slightly tinged with green. Washed with a little cold water in the centrifugal it gave a product almost white, and of a fine flavor. The crystals were large, hard, and bright, and such as would be most highly prized by refiners. The washed sugar, however, would need no refining. It is already in excellent condition for the table or the kitchen.

Subjected to analysis the Indiana sugar gave the following results:

Washed sugar.—Sucrose, 97.27; other sugars, .60 per cent.

Unwashed sugar.—Sucrose, 89.24; other sugars, 4.55 per cent.

DIFFUSION.

For many years the process of diffusion for separating the sugar from the beet cuttings has been practiced in Europe with the most favorable results.

During the years 1873–'74 extensive experiments with diffusion were made in Louisiana on the ribbon cane. These results were fairly successful, and showed a marked increase in the yield of sugar. A full report of this work is found in a pamphlet by Dr. Otto Krotz, superintendent, printed by L. Graham & Co., 73 Camp street, New Orleans.

Reserving a more extended notice of these valuable experiments, as well as a historical sketch of the progress of diffusion for my special report, I will pass at once to a summary of the results obtained by the experiments undertaken.

Perhaps it might be well to mention first of all that the theory of diffusion rests on the principle of osmose, *i. e.*, the passage of liquids and crystalline bodies in solution through thin partitions, *e. g.*, the walls of a vegetable cell. The sugar of the cane being held in solution in cells, it is only necessary to bring pure water into contact with them to cause an interchange between the sugar solution within and the pure water without.

Theoretically the osmose would continue until the sugar had distributed itself equally throughout the liquid, but in practice time is scarcely given for this maximum result.

If, after the first saturation, the external liquid be removed and water or a less saturated sugar solution be again brought into contact with the cells, another interchange will take place. As these steps continue, the quantity of sugar in the cell becomes less and less, until finally it is too small to warrant any further efforts for its removal. It is evident that the process of diffusion could never remove all the sugar from the cell, for if pure water be brought in contact with it each time it could only remove half of the total sugar still remaining in the cell.

APPARATUS.

The apparatus for the experiments in diffusion I had constructed by the Colwell Iron Company of New York. It consists of two parts, viz, the cane-cutter and the diffusion battery.

THE CANE-CUTTER.

This machine consists of a cast-iron disk, conical in shape, and carrying three knives shaped like the bit of a carpenter's plane. The canes are delivered to the cutter by a forced feed set to move at such a rate that the canes are advanced from $\frac{1}{8}$ to $\frac{1}{16}$ of an inch during each third of a revolution of the disk. The canes, being fed parallel to the axis of the machine, are struck by the knives in the conical disk at an angle of

about 35°, *i. e.*, the angle of inclination the cutting surface of the disk to the axis.

The disk revolves 500 to 800 times per minute. Each revolution represents ⅜ inch of canes cut. The rate of movement of the canes therefore is 187 to 300 inches per minute. The knives are easily detached when dull and sharp ones put in their places. I found that the knives should be ground about twice a day and sharpened with an oil-stone every two hours.

The dimensions of the experimental cutter are:

Diameter of disk	feet..	2
Thickness of disk	inches..	1⅜
Angle of inclination of disk		35°
Diameter of shaft of disk	inches..	2½
Length of shaft	feet..	4
Diameter of pulley	inches..	13
Capacity per ten hours	tons..	3.5 to 4

The disk was covered by a hood so that the chips could not be thrown into the room. These were received by a box underneath.

This apparatus at first gave some trouble on account of the feed, which was not properly arranged. When this was adjusted, however, the machine gave no further trouble. A cane-cutter, properly constructed, will always have one advantage over a cane-mill, viz, it will be difficult to break it or get it out of order. On the other hand, cane-mills are a constant source of trouble, and often by untimely breaking entail great loss on the manufacturer.

Instead of having the knives shaped as in the cutter just described, I think it would be better to have them thinner. The thick knife tends to break the chip into several pieces, in lines parallel to the axis of the cane. I am not prepared to say that this is a disadvantage. It certainly exposes a greater surface to the action of the diffusion juices. It may, however, by the rupture of a greater number of cells tend to defeat the idea of diffusion, which is percolation through unbroken membranes. The substance of the cane being much more brittle than that of the beet, it will be found quite impossible to secure for the diffusion process chips as perfect as the *cosettes* and *schnitzel* of the French and German factories.

CAPACITIES OF CUTTER.

It may be objected to the method under discussion that it would not be practical to construct machines to work on a large scale, say 200 to 400 tons of cane per day. Judging from my experience with the small mill and the experiments carried on in Louisiana, to which reference has already been made, I would say that such an objection is untenable. For equal weight of cane a cutter will, if properly constructed, be lighter and require less power to drive it than a mill.

I think that all cane-workers will be glad to give a fair hearing to the claims of a machine that will relieve them from the worry and expense of the choking, breaking, and creaking of the mills.

THE DIFFUSION BATTERY.

This apparatus consists of eleven cells arranged in such a way that a liquid from any one of them can be transferred to another, either from the top or bottom of the cell, at will. On one side is the system of tubes and valves by which this process is carried on. On top of the cells are the openings through which they are filled with the freshly-cut chips. Each cell ends below in an opening set obliquely to the axis of the cell through which the exhausted chips are discharged.

On the side opposite the feed-valves is found the steam-supply by which the cells or the liquid contained in them can be heated either from above or below. This heating should take place in separate compartments, which in large apparatus are called *calorisators*.

The water is forced through the cells by the ordinary pressure of the Washington water-works, which is less than the pressure of one atmosphere. The water as it flows to the cells passes through a heater where it can be brought to any desired temperature.

Such is a brief outline of this battery, a detailed description of which will be found in the special report to follow.

MANIPULATION.

The first cell being filled with chips and the openings all closed except the air-valve at the top, water from the heater at a temperature of 60° C. (or other desired degree) is admitted through the bottom of the cell until it began to flow out through the air-valve at the top. This is then closed, the valves changed so that the water enters from the top of the first cell.

The second cell is now filled with the liquid from the first cell which has meanwhile become charged with all the sugar it is capable of taking from the first chips. The valves are so arranged that the liquid from the first cell is forced out by the fresh water entering from above and into the second cell from below until this is filled.

The third cell is now brought into action in the same way, the fresh water entering still at the top of the first cell, the valves being changed for the second cell so that the liquid from the first flows in at the top of the second, forcing its contents out and up through the third cell. This process continues until nine cells have been filled with the liquid, the one with fresh chips always from the bottom, and all the others from the top. By this time the chips in the first cell, having been treated with nine successive portions of fresh water, have lost all but the merest trace of their sugar. This cell is therefore shut off from all the others, the fresh water is turned into the second cell, and while the tenth cell is filling the first one is emptied of its exhausted chips.

The fresh water is next turned on in the third cell while the eleventh one is filling. Meanwhile the first cell is prepared for its second change of fresh chips, and the process now goes on regularly, nine cells being always in use and two being filled or emptied.

RESULTS.

Analyses were made during the progress of the experiments to determine the completeness of the extraction and the character and quality of the diffusion juices, and to compare them with the juices of the same canes obtained from the mill.

The diffusion cells held 18.2 kilograms (40 pounds) of chips. This quantity was weighed and put in each cell. The cell, after being filled with chips, would still hold nearly 22 kilograms of water (48 pounds). The exhausted chips were found to have increased in weight, so that each cellful weighed nearly 22 kilograms.

The charge and discharge of a cell, therefore, are represented by the following table (approximately):

Weight of fresh chips taken	kilograms.	18
Weight of exhausted chips	do....	22
Weight of diffusion juice drawn off	do....	22
Weight of waste water drawn off	do....	22
Per cent. of diffusion juice to weight of chips	do....	122
Each 100 parts chips gave of juice	parts.	122

INCREASE IN VOLUME OF DIFFUSION JUICE OVER MILL JUICE.

A large number of analyses has shown that the total content of juice in the cane is 88 (nearly); of this amount about 75 are extracted by diffusion.

Whence it follows that a mill which would extract as much of the saccharine matter as diffusion would give, for each 100 parts of cane, 75 of juice; by diffusion, each 100 parts of cane, 122 of juice. Thus, 100 parts of mill juice would be represented by 165 parts of diffusion juice. The amount of evaporation required for diffusion juice is therefore a little more than one-half greater than for juice from the mill.

I regret that the delay in securing the diffusion apparatus did not allow me time and cane to finish the investigation with this interesting method.

Let us take, therefore, for an illustration, a cane containing 12 per cent. of sugar:

100 kilograms of this cane contains sugar	kilograms.	12
Loss, 5 per cent	do	2.5
Sugar obtained by diffusion	do	9.5
Per cent. obtained by diffusion		80

To illustrate this, I will say that analyses made of the exhausted chips and of the waste water showed that only one-half of 1 per cent. of sugar was lost in the process of diffusion. In other words, for a cane containing 12 per cent. of sugar, 11.5 per cent. were secured by this process, or 95 per cent. of the total amount. On the other hand, calculations based on weight and richness of juice of diffusion compared with juice from the mill, showed that only 85 per cent. of the saccharine matter was recovered. This discrepancy arises either from fault of the analytical process or from mistake in the weights of cane used and juices obtained. My attention was not called to this discrepancy in time to investigate it and determine its real origin.

I think it safer, therefore, in view of this uncertainty, to make the lower results the basis of any practical work. I will give, however, a sample of the results obtained by analysis:

100 kilograms of cane contained of juice	kilograms.	89
Obtained by mill	do	50
Per cent. obtained by mill		55
Per cent. of sugar obtained by mill		6.6
Per cent. of sugar obtained by diffusion		9.5
Per cent. of sugar gained by diffusion		2.9
Per cent. of sugar gained to total sugar		24

Thus, allowing a liberal loss of sugar in diffusion and taking a fair average result of single milling, we find a gain of 24 per cent. in sugar.

I will compare this theoretical result with one obtained in actual practice:

EXPERIMENTS IN DIFFUSION.

RUN OF NOVEMBER 9, 1883.

Cane diffused	kilograms.	990
Juice obtained	do	1,210
Waste water	do	1,210
Pulp	do	1,210
Sucrose in diffusion juice	per cent.	4.73
Other sugars in diffusion juice	do	2.12
Total sugars in diffusion juice	do	6.85
Total sugars obtained	kilograms.	82.89
Sucrose in pulp	per cent.	.27
Other sugars in pulp	do	.06

Sucrose in waste water	per cent.	.07
Other sugars in waste water	do	.07
Total sugars in pulp and waste water	do	.43
Total sugars lost	kilograms.	5.32
Total sugars in 990 kilograms of cane	do	88.21
Total sugars obtained	per cent.	93.97
Total sugars lost	do	6.03

It is thus seen that out of 100 parts of sugar in the cane on November 9, 93.97 parts were obtained. Compare with this the result of the theoretical mill-work:

Weight of juice from 990 kilograms, 50 per cent	kilograms.	495
Weight of juice not obtained	do	386
Juice and saccharine matters extracted	per cent.	57.3
Total sugars in 990 kilograms of cane	do	88.21
Of which obtained by the mill	do	54.85
Total sugars lost	do	33.36
Total sugars obtained	do	62.39
Total sugars lost	do	37.61
Total sugars lost by diffusion	do	6.03
Net gain by diffusion	do	31.58

It appears from the data of the analytical work that the gain in sugar by diffusion over ordinary milling is from 25 to 30 per cent., and over double milling from 15 to 20 per cent.

Until November 14 I was unable to use the small vacuum-pan which I had procured for these experiments, and therefore the results in *masse cuite* and sugar could not be kept separate.

On November 14 I obtained the following data:

Diffusion juice, November 14.

ANALYSES.

Specific gravity		1.0406
Sucrose	per cent.	6.04
Other sugars	do	2.16
Purity	do	67.5
Total solids	do	9.05

MILL JUICE, SAME CANE AND DATE.

Specific gravity		1.065
Sucrose	per cent.	9.95
Other sugars	do	3.29
Purity	do	64.4
Total solids	do	15.13

MASSE CUITE OBTAINED (196.4 kilograms).

Sucrose	per cent.	52.50
Other sugars	do	20.85
Weight of chips diffused	kilograms.	1,596
Weight of juice obtained	do	1,929
Weight of sucrose in *masse cuite*	do	103
Percentage of *masse cuite* to cane		12.28

LOSS OF SUGAR.

The pulp from the 1,596 kilograms of cane weighed 1,929 kilograms. It contained .12 per cent. of sucrose and .06 per cent. of other sugars. Then $1929 \times .0018 = 3.47$ kilograms of sugar lost in pulp.

The waste water from the above weighed 1,929 kilograms. It contained .01 per cent. of sucrose and .07 per cent. of other sugars. Then $1929 \times .0008 = 1.54$ kilograms of sugar lost in waste water. Total loss in both, 5.01 kilograms.

The *masse cuite* obtained is well crystalized, but the crystals are so small and the proportion of gum present so great, that I have not been able to purge it in the centrifugal. I shall allow it to stand for some time in a warm room and make another trial.

Another trial was made on Tuesday, November 20, of the same kind of cane as above (Link's Hybrid), which had been frozen on the preceding Thursday, and left since that time lying in the yard.

RUN OF NOVEMBER 20, 1883.

	Kilograms.
Chips diffused	1,447.8
Juice obtained	1,738
Pulp obtained	1,738
Waste water obtained	1,738
Semi-sirup obtained	276.3
Masse cuite	157.8

Analyses, November 20, 1883.

PER CENT. OF SUCROSE.

	Per cent.
Chips	7.68
Diffusion juice	5.63
Pulp	0.10
Waste water	0.026
Semi-sirup	28.94
Masse cuite	48.83

PER CENT. OF OTHER SUGARS.

	Per cent.
Chips	3.38
Diffusion juice	2.50
Pulp	0.06
Waste water	0.027
Semi-sirup	12.58
Masse cuite	22.15

RESULTS.

Percentage of *masse cuite* to cane diffused		10.9
Total weight sugar in diffusion juice (1,738×.0813)	kilograms	117.71
Total weight sugar in pulp (1,738×.0016)	do	2.77
Total weight sugar in waste water (1,738×.00053)	do	0.92
Total weight sugar in cane (117.71+2.77+.92)	do	121.40
Total loss in diffusion	do	3.69
Loss in diffusion	per cent	3.04
Total weight sugar and semi-sirup (276.3×.4152)	kilograms	114.72
Loss during evaporation to semi-sirup (117.71—114.72)	do	2.99

This loss was due to wastage, scum, and especially to the sediment and gum separated during defecation and which could not be filtered. Quite a quantity of the juice was lost in this way.

MASSE CUITE.

Total weight *masse cuite*	kilograms	157.8
Total weight sugar in *masse cuite* (157.8×.7079)	do	112.01
Loss in reduction from semi-sirup to *masse cuite* (114.72—112.01)	do	2.71

The total loss of sugar during evaporation was 2.99+2.71=5.70 kilograms, or nearly 5 per cent. of the total weight of the *masse cuite.*

This practical result is in harmony with the experience of the best sugar manufacturers, who always allow for 5 per cent. loss in boiling.

The practical results of the diffusion process, in so far as they can be determined by operations in a small way, are satisfactory, and warrant the trial of the process on a much larger scale.

The experimental work has given many valuable suggestions concerning the process, relating to time the liquid should remain in each cell, the temperature at which it should be worked, and other less important matters.

While I do not regard the few experiments of one season as sufficient to definitely determine any of the problems of diffusion, yet I may say that a few facts seem to be already pretty well established. It must be

remembered, however, that the data gathered from working a model cannot always be relied on when the machine is operated on a large scale. Therefore, many of the results of experiment may be materially modified by large operations.

So far it appears that the best temperature for working lies between 40° and 60° C. Below this limit the sugar does not appear to be well extracted; above it the juice becomes colored, and the starch and gums rapidly increase.

The purity of diffusion juice obtained between the temperatures of 40° and 60° is great, and leaves little to be accomplished in the defecator.

In many of the analyses the total solids, less ash, were but little greater than the total sugars, and this, too, with cane remarkably poor in sugar and remarkably rich in other substances.

The only canes I had to work by diffusion were of the red-top and Links hybrid varieties. The former was deficient in sucrose and the latter rich in gums.

RELATIVE COST OF DIFFUSION AND MILLING.

It cannot be denied that, in a small plant, such as the apparatus I used for these experiments, the cost of procuring the diffusion juice is far greater than for juice from the mill. In a large plant, however, working from 150 to 300 tons per day, the difference in cost would not be so marked. Nevertheless I think with a diffusion battery in cells the cost of working will always be greater than for a mill using the same amount of cane.

There is, however, a machine called a "continuous diffuser," which removes this objection of extra expense. One of the best forms of continuous diffuser is the system invented by Mr. Perret, of France. In this machine there is a continuous transition of the chips, they moving in one direction and the diffusion liquid in the opposite. This device is said to work excellently with beets, and there is no reason why it should not do equally as well with cane.

My experiments have been so successful as to merit a trial of diffusion on a larger scale. I recommend, therefore, that Congress be asked to appropriate a sufficient sum of money to give this system a thorough trial. I will allude to this subject again in the general summary.

EXPERIMENTS WITH DEFECATION.

To remove from the juices of sorghum cane the substances not sugar is the second great problem in sugar-making. We find in the mature sorghum a plant nearly as rich in sucrose as the average sugar-beet of Europe, and containing two-thirds as much of it as the sugar-cane of the tropics. Why, then, is the problem of sugar-making from it so hard, and why has so little sugar been successfully made? The answer to this question is twofold.

(1) The sorghum cane contains, beside sucrose, another sugar or other sugars, which are not crystallizable in the ordinary way. This substance is a peculiar one. It is sweet, it has a reducing action on certain metallic salts, notably those of copper and mercury. In these respects it resembles sucrose (in sweetness) and dextrose (glucose) (in reducing effect). But it differs from both of these sugars and from the invert sugar made from sucrose in being optically inactive, while sucrose and dextrose turn the plane of polarized light to the right (in different degrees), and invertose (at certain temperature) to the left, the "other sugars" in sorghum do not have any or very little influence on it. To distinguish this variety of sugar from the other forms it might be called *anoptose.*

Experience has shown that this sugar acts on sucrose like many a mineral substance and organic bodies, *i. e.*, it prevents nearly or quite its own weight of sucrose from crystallizing.

(2) In addition to this sugar, sorghum juices contain a notable quantity of mineral matter (ash), some starch, and perhaps traces of other hydrocarbons, albuminoid bodies, chlorophyl, acids, &c. All of these bodies are active in preventing sucrose from crystallizing.

Thus it happens that the extraction of the sucrose from sorghum juices is often difficult and sometimes impossible by any of the ordinary methods.

The object of defecating the juice is to remove as much of these disturbing substances as possible. Two reagents stand prominently above all others which have been prepared for the purpose. These are lime and sulphurous dioxide. These two reagents, aided by heat, are capable of removing a great deal of the objectionable matters present in sorghum juices. In the work at the large mill *this* year these were the only defecating reagents I used.

Sulphurous acid is used in two ways: (1) It is either injected into the juice (or in some other way mixed with it), or else (2) combined with lime and added in the form of lime bisulphite. The latter method is easiest and is the one which I employed here. In working the Indiana amber both methods were combined.

MIXING SULPHUROUS DIOXIDE (ACID) WITH THE JUICE.

(1.) The sulphur is burned in a suitable furnace, and the fumes conducted into a box 6 to 8 feet high. This box has perforated shelves. The juice entering at the top of the box pours from one shelf to another. The sulphur fumes are drawn upward by a flue at the top of the box and are thus brought into intimate contact with the juice.

(2.) The sulphur is burned as before, and the fumes conducted into a tight box furnished with a revolving paddle. The juice from the mill entering this box is beaten into a spray and thus thoroughly exposed to the gas.

Having tried both the above methods I much prefer the second one.

(3.) The fumes of the burning sulphur are forced, by a pump, through fine holes in the end of the delivering tube (or in a coil), in minute bubbles, into a tank containing the juice.

Although I have never given this method a practical trial, I am of the opinion that it is the best of the three.

MANIPULATION.

Following is the method of defecation which was employed in the mill work during the present season:

The bisulphite of lime solution (specific gravity 10° B.) was run into the juice as it came from the mill. The average amount added was 4 liters to each 20 hectoliters of juice (1 gallon to 500).

The proper amount of juice having been collected in the defecator, the steam was turned on and the temperature raised to 66°–70° C. Cream of lime (specific gravity 15° B.) was then added with constant stirring until the juice was exactly neutral to litmus paper. The quantity of lime required of course varied with the quality of the cane. The average amount was a little greater than quantity of bisulphite used.

As soon as the juice was neutral it was rapidly raised to the boiling point, but was not allowed to boil. After five minutes the scum was removed and the juice allowed to pass into the receiving-tank below

through bag filters. In this way a clear juice was obtained, of a bright amber color and of an agreeable taste.

LIME.

This reagent, used as above indicated, has a most salutary effect on the juice. It combines with the free acids of the juice, forming mostly insoluble components, which readily subside or are easily filtered off; it helps to precipitate and remove the albuminous substances present, and in other ways to purify the juice.

OTHER REAGENTS.

All costly substances like tannin and caustic potash, all poisonous substances like lead and alum, I pass over as being at present inapplicable in a practical way.

OTHER EXPERIMENTS IN DEFECATION.

In addition to the above defecations made in the course of manufacture, I made an extended series of experiments with the method of defecation used in Europe on the juices of the beet. These experiments were under the immediate charge of an assistant who has had large experience in beet-sugar factories in France.

The method consists essentially in first adding a large quantity of lime to the juice and afterwards removing it by the injection of carbonic acid.

The result of these experiments was most flattering. In many cases the coefficient of purity was considerably raised, and in all cases the defecated juice was bright and clear, and of a reddish-yellow tinge. This coloration is due to a slight decomposing effect which the lime, even in the cold, has on the anoptose, forming with it dark and bitter decomposition products. This deepening of color, however, does not affect the value of the process for sugar-making, although it would be an objection if sirup alone was the object of manufacture.

A few results will show the workings of the method. The analyses in detail will appear in the forthcoming special report.

No. 1. A mill juice with a coefficient of purity of 61.60, after treatment, as indicated above, had this number raised to 69.12. In the same juice the percentage of albuminoids before defecation was 4.22 and after defecation 3.42.

No. 2. A diffusion juice before treatment had a purity coefficient of 59.67 and after of 59.79. In the same juice the percentage of albuminoids before treatment was 4.06 and after treatment 3.63.

In most cases the treatment of the diffusion juices gave somewhat better results. In nearly all cases the relative amount of anoptose to sucrose was diminished, showing that a small portion of it was destroyed by the excess of lime.

In general I may say that this method of treatment succeeds better with mill than with diffusion juices, and for the obvious reason that the former have more impurities that can be removed by lime than the latter.

GENERAL CONCLUSIONS.

SMALL MILLS.

The prevalent idea that each farmer will become his own sugar-maker, and that sorghum cane is destined to furnish that supply, I do not hesitate to pronounce erroneous. For nearly thirty years such experi-

ments have been carried on by farmers throughout the middle and northern parts of the country, and yet no success has attended them. In many cases even the sirups made in this small way are far from being palatable. They often contain the acids and other impurities of the juice, and have an acrid, unpleasant taste. The successful manufacture of sorghum sugar presents greater difficulties than the working of the sugar-beet. In this there is only one sugar, viz, sucrose, and its separation is not hindered and prevented by large quantities of its uncrystallizable kindred. Three-quarters of a century have placed the manufacture of beet-sugar on a paying basis, but have not brought it to its limits of perfection. The northern sugar industry in this country is yet in its infancy, and it is not strange that its methods are still crude and unsatisfactory. It seems that the advocates of the industry have often had more zeal than knowledge, and I have noticed that with increasing experience the prophecies of experts have grown less extravagant. If the success of small mills has been almost none, it does not follow that that of large ones has been great. But one thing the large factories have shown, *i. e.*, that sugar-cane can be made, how profitably or unprofitably cannot be said. The factories at Rio Grande, N. J., Champaign, Ill. Sterling and Hutchison, Kans., have made sugar this year perhaps in all a million pounds. But a million pounds is a small contribution to the sugar consumption of the country, and the time appears still distant when the United States will make its own sugar. Near large factories farmers may make their own sugar by raising a few acres of cane and exchanging it at the factory for sugar. Cane that will produce 60 pounds to the ton ought to yield the farmer 35 pounds of sugar. The other 25 pounds and the molasses would pay for working, and yield, I think, a fair profit. Under these most favorable conditions the farmer would get 350 pounds sugar per acre. I do not know of any other way in which he can get that much sugar out of an acre of sorghum cane. I do not write in this manner to discourage efforts to make sugar profitably in a small way. If such a method could be devised it would certainly be a great advantage to our farmers. The cost of the sugar for a farmer's family is one of the chief expenses of the household, and often takes so much of his available cash that he finds it difficult to raise money to pay his taxes.

If large factories are started throughout the country, the farmer may find it profitable to cultivate cane and sell it to the manufacturer. What price should be paid for canes, and how their value should be determined, are questions which the ordinary experience of commerce will answer. The whole question is yet *sub judice*, and only ignorance or egotism could be pardoned for answering it either for the present or the future. The small sorghum factories, with their crude sheds and mills, and often cruder methods of concentration, will continue to dot the landscape of the central and northern belt of States, and the products of these establishments, when made by intelligent direction, will continue to be valuable.

LARGE FACTORIES.

The chemist and the skilled laborer are the Moses and Aaron who are to conduct the sorghum hosts out of the wilderness, where it seems they are to wander for forty years. Only the large establishments can with economy employ them. It requires as much chemical science and as much skilled labor to work one ton of cane into sugar as it does a thousand. Moreover, sugar machinery is expensive. The boilers and engines must be large and of the best quality. The mills and diffusers are heavy

and expensive. Then come the open evaporators, the double and triple effect and strike-vacuum pans, with their pumps and appurtenances. Then the sugar wagons and centrifugals are not to be forgotten. If animal char is employed it requires additional and expensive apparatus. Counting every expense, except the cost of land, the capital required to work ten thousand tons of cane per season will not fall much short of $75,000, and may exceed that sum if strong, permanent buildings are erected.

WILL IT PAY?

Few persons are willing to engage in the sorghum business from mere sentiment. Those who go into the business have a reasonable hope of success. The question, "Has it paid?" can almost be answered in the negative. It is true that some small profits have been made in the manufacture of sugar, but the business is too young to be pronounced absolutely profitable. After carefully considering all the testimony accessible, I do not hesitate to say that there is considerable risk of loss in sorghum-sugar factory investments as the business is now carried on. The present process is a wasteful one. This waste occurs everywhere in milling. It is also found in the scums and sediments, in the seed and bagasse. At Rio Grande, however, the scums and sediments are preserved and used for manure. They make a fertilizer that is but little inferior to guano. The bagasse is put into the pig pens, where it is soon transformed into a valuable manure. The seed is carefully preserved and fed to the hogs. In many other places the scums and sediments are largely allowed to run to waste or given away, the bagasse is burned, and the seed allowed to rot in the field. All these little leaks together make quite a loss. It is certainly wasteful to burn the bagasse. At Champaign, Ill., where they have the best bagasse furnace in the north, Professor Weber told me that they did not save more than 25 per cent. of coal. The bagasse, if not used for a manure, will make a good quality of paper.

I have this year made, in a small way, from diffusion chips, a most excellent article of paper pulp, nearly white, and quite tough. I think it would make a fair article of print paper. When experience has taught us to save all that is now wasted, and diffusion has succeeded in extracting practically all the sugar, I think we may safely say that the business will pay.

In conformity with the instructions you gave me at the beginning of the work this year, I have sought to be simply an investigator. I desire that all who study the general results obtained shall judge them without bias. It is easy for the enthusiastic advocate to find encouragement in the most disheartening facts, while the prejudiced opponent can see nothing hopeful in the most flattering results.

MOLASSES.

There is still another factor in the sorghum problem which must not be left without attention. If the production of sugar from sorghum should prove profitable, it is certain that the industry will rapidly spread, and the production of sugar increase until it equals the demand of the country. The history of the progress of the beet-sugar industry in France and Germany teaches us that this will be the event which is certain to occur. When this happens the product of molasses will be enormous, far greater than the demand of ordinary consumption will dispose of. On account of the large percentage of uncrystallizable sugar which the sorghum juices now contain, the yield of molasses in

the manufacture will be far greater than with the cane of the tropics or the beet of the temperate zones.

As I have already shown, the proportion of uncrystallizable to crystallizable sugar in the sorghum sap is about one to three. This sugar prevents nearly an equal weight of sucrose from crystallizing. By the methods in use at the present time a yield in dry sugar of one-third of the total sucrose present in the juice is an exceedingly gratifying one. It follows, therefore, that the weight of molasses produced (including the water) will remain four times that of the sugar in the most favorable of the present circumstances. It is idle to suppose that such quantities of molasses can find their use in culinary economy. The only remaining uses to which the molasses can be put are food for animals and distillation. There is little doubt but that the conversion of the sugars in the molasses into alcohol will prove far more profitable than feeding them to stock.

I have made, in illustration of this opinion, some very fair samples of alcohol and rum, and the success which has attended these experiments is sufficient to justify the conclusion that a much greater increase in sorghum production throughout the country will result in the use of the molasses on a large scale as a source of alcohol and rum.

PRODUCT OF ALCOHOL.

I will give an illustration to show the theoretical yield of alcohol in order to furnish data for calculations of the yield on a large scale.

Molasses, after the second or third crystallization, contains about 32 per cent. each of sucrose and non-sucrose, in all 64 per cent. of fermentable matter. Under favorable conditions the sugar present will yield 40 per cent of its weight as alcohol, or 25 per cent. of the weight of molasses. One gallon of molasses, therefore, weighing 11 pounds, would give 2.75 pounds absolute alcohol, 3.03 pounds, 90 per cent., alcohol, and 5.5 pounds whisky or rum. Thus each gallon of molasses would give nearly half a gallon of commercial alcohol and two-thirds of a gallon of whisky or rum.

AIM OF FUTURE EXPERIMENTS.

The results of the experiments made this year by this division and of the practical work of the factory at Rio Grande during the past three years, and of the factory at Champaign for two years, and of the experiments made prior to these by the Illinois Industrial University, and by the Wisconsin Agricultural College, have definitely answered the question "Can sugar be made from sorghum?" in the affirmative. The prosecution of further experiments, therefore, in this direction would be a useless expenditure of time and money. I therefore recommend that they be discontinued.

But there are other questions of equal importance which have not been answered, and which fall properly within the field of experimental investigation.

"HOW TO OBTAIN THE MAXIMUM YIELD OF SUGAR FROM THE CANE?"

The experimental trial of diffusion during the past season has shown how this question will probably be answered. It is now the duty of this division to undertake a field experiment on a scale large enough to furnish data for manufacturing purposes. The cost of land and labor is so very great in the vicinity of Washington, and the quality of the land is

so poor, that it will be impossible to make a fair experiment here. I recommend, therefore, that you select some favorable locality in a good agricultural region where the cane can be grown and labor secured on strictly business principles. Some parts of Maryland or New Jersey are suitable for this purpose, but I think better results could be secured in North Carolina, Southern Indiana, or Illinois, Missouri, or Kansas. A diffusion battery or continuous diffuser would cost $8,000, and the other machinery $25,000.

My experiments have already shown that the yield of sugar is increased fully 20 per cent. by diffusion. If this increase continues on a large scale (and there is no reasonable doubt of this), it would be a contribution to the cause of agriculture in our country which would save annually enough to pay many times the cost of the experiment. Such machinery, too, is valuable after the official use has ceased and would bring back into the Treasury a large part of its original cost. The money for such a practical work should be made immediately available, if anything is to be accomplished during the coming year. The customs receipts from sugar alone for half a day would afford ample funds to carry out this work. Certainly any reasonable appropriation looking to the production of our own sugar is one which should meet with the hearty approbation of Congress.

EXPERIMENTS IN CULTIVATION.

Equally as important as the above is the question, "*What parts of the country are most favorable to the growth of sugar-producing plants?*" With the tropical cane this question is already answered. But with sorghum and the sugar-beet it is still undecided. Only systematic experiments, conducted under the direction of the Department of Agriculture, can give a satisfactory answer.

Following are the points which take precedence in the investigation:

1. Kind of climatic conditions.
2. Kind of soil.
3. Kind of fertilizers.
4. Varieties of cane or beet.
5. Effect on soil.

I recommend that you make arrangements with the agricultural college of each State, or other reliable institution or citizen, to carry on experiments in the directions indicated above. For this purpose it will be necessary for Congress to make an appropriation of $1,000, or other sufficient amount, to be paid by you to the proper authorities of each State or private institution undertaking the work.

At first experiments should be undertaken with a few kinds of the best approved varieties of the beet and cane. Two acres of land will be enough for each State. This should be divided into ten plats. Five of these should be planted with sorghum, four with beets, and one with Indian corn. The yield of corn will serve as a measure to determine the productiveness of the soil and character of the season. Analyses (uniformly carried on) should be made of the soil, fertilizers, and products.

In the fall (or spring following), after the analyses are completed, the whole number of plats should be planted in wheat of a kind suitable to the locality. The yield of wheat will be a measure of the comparative effects of the different products on the fertility of the soil.

Such a series of experiments carried on under uniform conditions over the whole country would do more in five years to determine these great

agricultural problems than fifty years of spasmodic and disjointed work could accomplish. I have only mentioned here the outlines of the future scope of the experiments in sugar culture, experiments in which every part of the country will take a part and feel an interest. If they become authorized by law, it will be easy to systematize and formulate all the details of the operations to be carried on.

IMPROVEMENT OF SEED.

Much of the success of the beet-sugar industry of Europe has been due to a wise selection and improvement of the seed, by which the sugar contents of the beet, in some instances, has been nearly doubled. There is no reason to doubt that a similar improvement (but not, perhaps, to the same extent) could be made in northern cane. Such an improvement station could be established at small cost; but, to be effective, must be continued through a series of years. The seed of those canes showing the highest sugar content should be planted and the selection continued until a maximum of sugar is obtained. If in this way a variety of cane could be produced which would give an average result in analysis of only 2 per cent. uncrystallizable sugar and 10 per cent. of sucrose, it would prove of the greatest value to the country.

I cannot conclude this summary of the season's work without thanking my assistants for the industry which they have shown in accomplishing a vast amount of work, and you for the generous manner in which you placed every possible help at my disposal which could assist in making the work of the division successful.

Respectfully,

H. W. WILEY,
Chemist.

Hon. GEORGE B. LORING,
Commissioner of Agriculture.

NOVEMBER 23, 1883.

FORESTRY DIVISION.

SIR: I have the honor herewith to report the work of this Division for the current year.

To deal with any subject successfully an accurate knowledge of the facts relating to it is necessary. The subject of Forestry in our country opens a very wide field of inquiry, embracing many particulars. It involves the ascertainment, not only of the actual amount of forest-covered land in our extensive domain, but its relative distribution in the different sections of the country. It requires a knowledge of the kinds of trees which constitute the forests, the density of their growth, and the uses for which the trees are adapted. It calls for the study of the geological and climatic conditions of the country as related to the growth of forests. It necessitates investigation as to the actual condition of the forests, the rate of their increase or diminution, and the causes of the same. It leads to investigations of trades and manufactures based upon the products of the forest. In fact there is hardly any limit to the inquiries which arise in connection with this subject.

In previous years the Department has secured valuable information in regard to the production and consumption of lumber, and of bark used for tanning purposes. It has also made extensive inquiries

in regard to forest fires, the result of which, published in the last annual report of the Department, furnishes a body of information on this important subject nowhere else to be found.

CONSUMPTION OF WOOD FOR RAILROAD CONSTRUCTION.

Since that report was made a large number of circulars have been addressed to the various railroad companies of the country, numbering nearly 300, for the purpose of ascertaining the extent to which the forests are drawn upon in the construction of the roads, the kinds of trees used for railroad ties, the duration of different kinds of timber used for this purpose, the means taken to increase their durability, and other facts related to the subject.

Reports have been received from companies owning or managing 70,880 miles of road, or about 63 per cent. of the whole. Assuming the present length of railroad track to be 112,000 miles, the average distance apart at which ties are placed is 3 feet, requiring 2,640 ties for each mile, or for the existing length of roads 295,680,000. The railroad companies almost invariably require, in building and maintaining their tracks, young and growing trees, such as are large enough only to make one tie for each cut. Trees of this size will not average more than two cuts each. Consequently the construction of our existing roads has taken 147,840,000 trees. Our woodlands, as they are, will not furnish more than 100 ties to the acre. Our roads, therefore, have taken the trees growing on 2,956,800 acres of ground, or a tract of land nearly as large as the State of Connecticut.

The average duration of ties, as given by the returns, is seven years. To maintain the roads, therefore, one-seventh of the original number of ties must be supplied every year, or 42,240,000, or the product of 422,400 acres. In determining the actual demand of the railroad companies upon the forests for construction purposes no account has been made of the annual increase of the roads. It ought, also, to be considered that the roads take the trees just at the period when they are about to make their most valuable growth, as it is well known that most trees after the age of thirty years make a much greater proportionate growth from year to year than in their earlier stage, and their wood becomes also more valuable for most purposes. For instance, a tree measuring 16 inches in diameter will produce double the amount of sawed lumber that can be cut from a tree measuring 12 inches.

The annual revenue from the growth of an oak tree of the species commonly used in ship-building has been very carefully determined from the mean of a great many records in France, and is as follows:

		Francs.	Centimes.
Tree 50 years old	per annum	0	10
Tree 100 years old	do	0	80
Tree 150 years old	do	2	00
Tree 200 years old	do	4	00

The consumption of our forests in railway construction is seen, therefore, to be even greater than the figures indicate, and very wasteful.

Assuming that it will usually require thirty years for trees to grow to the size requisite for furnishing ties, in order to keep up the supply for the existing roads there will be needed thirty times the area which is necessary for the supply in any particular year, or 12,672,000 acres, an area somewhat larger than that of the States of New Hampshire and Vermont. These comparisons show in an impressive view the present demands of our railroads upon the forests for their construction,

but with the annual increase of the roads this demand will be increased. Many of the roads are also making a far greater demand upon the forests for fuel than they are for ties. The railroads of the South use wood almost wholly for this purpose. We have no statistics as yet in regard to the amount of wood thus consumed. An estimate for the single State of North Carolina puts the consumption at 250,000 cords annually. But if we take this into account and also the amount of lumber necessarily used in the construction of cars, we cannot fail to see that the railroads are making very great demands upon our forests, and that these demands are enlarging every year.

DESIRABLE TREES FOR PRAIRIE STATES—CAUSES OF FAILURE IN PLANTING.

The rapidity with which settlers have poured into the so-called prairie States within the last few years, and the great destitution of trees which characterizes those States, has given the subject of forestry in connection with that region peculiar importance, and a peculiar claim upon the attention of the Government. Accordingly, circulars have been prepared and sent to trustworthy persons in those States, asking the following questions:

1. What kind of trees, in the order of preference, have been found to grow successfully in your township? Note any particular facts as to spring or fall planting or sowing, the situations most favorable for growth, or any other facts of interest.
2. What kinds of trees have been tried and have not proved successful?
3. What injuries have been noticed to occur from insects or other causes?
4. What other difficulties have been noticed in attempts at tree-planting?
5. Give general remarks upon the collection and preservation of seeds or young plants, their planting and management, the kinds that promise to be the most profitable for cultivation, the preparation of the soil, intervals between trees, and other subjects of interest.

During the year two thousand or more replies to these circulars have been received. These have been compared with each other, classified by States and counties, and reduced to tabular form so as to be available for easy reference. In attempting to make these reports of practical value to those who are proposing to plant, a difficulty arises on account of the different bases of judgment assumed by the persons making the reports. For instance, in endeavoring to ascertain what trees have been grown successfully in any given county and the order of preference, it was found that the standard of judgment with some was rapidity of growth, while with others it was value for timber. Allowance had to be made for such differences of judgment on the part of those reporting. Making proper allowance on this account, the tables appended to this report will show at a glance, for any portion of the prairie States, not less than a county in extent, what trees are most desirable for the planter in that particular locality, and what are the chief difficulties to be encountered by him. It is hardly necessary to say that the reports from the older States are the most valuable and trustworthy, because there has been a longer experience in tree-planting in those States, and more opportunity to observe the results than in those in which tree-planting has, so to speak, but just begun.

It will be seen also that a comparison of the various tables is necessary in order to arrive at trustworthy conclusions as to the facts of the case. A particular tree may be reported as having failed in some section. But, on examination, it may be found that the report of failure has been made by only one person, while, on turning to the records of successful cultivation, it may be found that several persons here make a favorable report. To facilitate such a comparison of the returns, the number sent

in from each county is noted in the margin. It will be noticed that among the difficulties encountered, or the hindrances to successful planting, most frequent mention is made of carelessness or neglect in planting or subsequent cultivation. Climate, or the character of trees, is not so much in the way of successful tree-planting as the ignorance or neglect of the planter.

But, after all, we have attained as yet only approximations towards the truth. So many things have a bearing upon success in planting, such as the geological character of the soil, its exposure to sun and wind, its geographical situation, the amount and distribution of rainfall, the means and extremes of temperature, &c.; and then the condition of the tree at the time of planting; its age, the soil from which it has been taken, the process of planting, the after care, the character of the season, and atmospheric conditions to which the tree is subjected soon after being planted—all these things have much to do in determining whether the planting of a given tree or collection of trees shall be attended with success or prove only a failure. It will be only after the experiments of subsequent years shall have given us a wider range of facts from which to deduce our conclusions that we shall be able to decide with confidence what trees are best adapted to any particular location. The information already attained, however, is valuable. We have ascertained where some trees will thrive and where they will not. We know enough to encourage us in the work of tree-planting. With the knowledge we have we can reach valuable, if not the best, results. And as we continue to engage in planting we shall be constantly adding to our store of facts and getting the means of securing from year to year a larger measure of success. It will be the legitimate office of the Department to gather up the facts from the wide field of experiment, as experiment goes on, and, by publishing them from time to time, extend the benefit of them as far as possible. It will not only record the experience of different workers throughout our own country, but gather lessons from what is doing and has been done in other and older countries, and make their experience also tributary to our own success.

SPECIAL AGENTS.

In addition to the distribution of circulars already referred to, in the month of May last four special agents were appointed by the Department for the purpose of examining and reporting upon the condition of the forests, timber culture, &c., throughout the country. One of these—Dr. John A. Warder, of Ohio, so long and well known for his scientific and practical knowledge of trees, and for his zeal in promoting their cultivation—was in such feeble health at the time of his appointment that he was unable to enter upon the discharge of the duties of his office. His health continued to decline, and his death took place in midsummer. The portion of country assigned to him for investigation has since been divided among the other agents. It could not be expected that three or four men would be able to make any other than a most cursory investigation of the wide field assigned them, within the brief time that has elapsed since their appointment, or make any other than the most general report. The examinations made by the few agents in the field, however, have not been without valuable results already. The Hon. R. W. Furnas, reporting from the Pacific coast and the Rocky Mountain range, shows that the consumption of the forests in the manufacture of lumber is rapidly increasing, while their destruction by fire is both reckless and alarming.

In California, poorly supplied with timber at the best, the forests are being destroyed with fearful rapidity. Governor Furnas gives the amount of lumber consumed and handled at San Francisco alone during the year 1882 as 2,500,000,000 feet, which is a great advance upon the consumption of 1880, as reported by the census taken that year. These figures do not represent with accuracy, indeed, and by no means with completeness, the consumption of the forests of California, as a considerable portion of the lumber handled in the San Francisco market is the product of more northern forests. Los Angeles received between January and June, 1882, 85,000,000 feet of lumber, and from the same sources from which the market of San Francisco was supplied. The redwood is the principal lumber tree of California, and Mr. Furnas estimates the amount remaining uncut, notwithstanding the large amount cut in the two last years, as the same that was reported by the census of 1880, as since that report was made some new sources of lumber supply have been discovered. The estimated existing supply is 25,825,000,000 feet.

The redwood is peculiar among coniferous trees, as it sends up shoots from the stump when cut. With proper care, therefore, this most valuable tree of the Pacific slope might be maintained throughout all that coast region, which seems to be its native place. California has no mine of wealth equal to this in value, and every consideration urges that State to take the most efficient measures to preserve this most precious of her treasures. But hitherto she has sacrificed her forests to an alarming extent. Scantily provided with trees at the best, her forest area is now reduced by one-quarter, if not more, from what it was when that State became a part of the United States.

The introduction into Southern California of the Eucalyptus, or Australian blue-gum tree, promises to be of great advantage, as by its rapidity of growth, equaled perhaps by that of no other tree, it furnishes the means of soon clothing with forests the almost treeless surface of large portions of that region.

Oregon and Washington Territory are heavily timbered. But a large consumption of the forests, especially in Washington Territory, is already taking place through the activity of the lumbermen, who, with the opening of the Northern Pacific Railroad, are transferring their operations from the nearly exhausted pineries of the lakes and the Upper Mississippi to the fir forests beyond the Rocky Mountains. The whole western coast of the American continent and the eastern coast of the Asiatic offer a limitless market for the lumber of the Puget Sound region, and the lumbermen seem eager to reap the offered harvest. But worse than the threatened consumption of the great forests of the Pacific slope of the Northwest by the lumbermen, is that of the forest fires. These Mr. Furnas characterizes as "simply fearful—criminal."

ENCOURAGEMENT FOR PLANTING ON THE TREELESS PLAINS.

Mr. Furnas makes an encouraging report in regard to the success of planting on the comparatively treeless plains of Nebraska. When the Indian title to that portion of our country was extinguished, in 1854, it was supposed to be a timberless region. Along the valley of the Missouri River, however, which skirts the eastern border of the State, there was a narrow strip of valuable and well-matured trees, oaks, black walnuts, ashes, elms, hackberry, red cedar, honey locust, sycamore, soft maple, box-elder, willows, and cottonwood, the latter being the predominant tree. In the valleys of the Platte and other streams was found a

smaller and more recent growth of the same varieties, with the addition of hickories, lindens, the Kentucky coffee-tree, the buckeye, and others of less importance. In the northwestern portion of the State a growth of white pine was found of sufficient size to be used for lumber, but too young and immature to be of much value. After a time it was found by experiment that there was nothing in the nature of the soil or climate to prevent the growth of trees on the open prairie and away from the streams. Seedlings transplanted into well-prepared ground and protected from the prairie fires grew with vigor and rapidity, and now "tree-growing in Nebraska is universally conceded a success."

Official statistics show that there have been planted two hundred and forty-eight thousand four hundred and ninety-six (248,496) acres of forest trees, and it is estimated that there has been a spontaneous growth of trees, since settlement, sufficient to cover half as many acres more. Mr. James T. Allan, of Omaha, says there are not fewer than forty-three millions of forest trees growing in Nebraska, where, but a very few years ago, not a tree could be seen on her wide prairies.

For the encouragement of tree-planting the constitution of Nebraska prov des that—

> The increased value of lands by reason of live fences, fruit and forest trees grown and cultivated thereon, shall not be taken into consideration in the assessment thereof.

A State law also exempts from taxation for five years $100 valuation for each acre of fruit trees planted, and $50 for each acre of forest trees. It is also made obligatory that—

> The corporate authorities of cities and villages in the State shall cause shade trees to be planted along the streets thereof.

Further:

> Any person who shall injure or destroy the shade trees or trees of another, or permit his or her animals to do the same, shall be liable to a fine not less than $5 nor more than $50 for each tree injured or destroyed.

To encourage the growing of live fences the law permits planting—

> Precisely on the line of the road or highway, and, for its protection, to occupy for a term of seven years six feet of the road or highway.

ARBOR DAY.

Nebraska has the distinction of having originated Arbor Day, or tree-planting day, through the wise action of its State board of agriculture. The board annually award liberal premiums for the greatest number of trees, cuttings, and seeds permanently planted on that day. The governor of the State, by annual proclamation, recognizes the day for the purpose indicated, and urges the people to devote it exclusively to tree-planting. It is very generally observed and millions of trees are annually planted. Its observance has extended into other States, with equally valuable results, and it would be a good thing if it were adopted in all the States. Where planting is not needed on so extensive a scale as it is on the naked plains of the West, there would be found opportunities enough for the exercise of the tree-planter's art on many a bare and barren spot, along the roadsides, in door-yards, in parks and cemeteries, about school-houses and churches, and in many other places. Such days might be made also among the pleasantest occasions of meeting on the part of the dwellers together in villages and neighborhoods and exert a healthful influence in more ways than one.

In some of the States an arbor day has been set apart in connection with the public schools, and the pupils have been encouraged to plant trees in memory of eminent authors or other distinguished persons.

This custom happily tends to interest the children in their studies at the same time that it inspires them with a love of the trees. The usage is in every respect desirable and might well be extended to all our schools.

Early in the year F. P. Baker, Esq., of Topeka, Kans., one of the special agents of the Department, made a preliminary report on the forestry of the Mississippi Valley and tree-planting on the plains, which was of great value and has been given to the public as a special report from the Department. Recently Mr. Baker has made a supplementary report, which contains much valuable information and makes some very important suggestions in regard to the care and disposal of the public lands.

The special agents of the Department have been directed to prosecute their inquiries still further, by means of circulars addressed to persons in all parts of the country, and especially to those engaged in the manufacture of lumber. It is expected that by means of these inquiries we shall obtain more exact information in regard to the consumption of our forests and the uses to which our woods are put than we have had hitherto.

EXTENT AND VALUE OF FOREST PRODUCTS.

The investigations already made and the reports received from the special agents of the Department, as well as from other sources, serve to show with increased clearness the very great importance of the forests in our country, and to enlarge the scope of the work which properly belongs to this Division. The census of 1880 was the first to take any adequate account of the forestal resources of the country, and it is only by means of the information thus gained and that secured by this Department within a few years past, that we have been able to attain anything like an accurate and satisfactory knowledge of the amount, condition and value of our forests. While most persons perhaps have a general impression that our lumber products are large and that the forests are valuable for their supply of fuel and as affording the material to a great extent of our house-building and ship-building, for the construction of railroads and for some other purposes, there are a thousand industries equally dependent upon the forests, but which are hidden from the general view and are, therefore, comparatively unknown. It is not until by proper inquiry we trace out the various uses of the forests that we are able to get an adequate notion of their importance. When that is done, and in proportion as it is done, we find that there is no other interest of the country so great as that of the forests, considered merely from the commercial or pecuniary point of view, while in other aspects its value is altogether beyond computation.

The most careful and trustworthy estimate of the value of our forest products fixes it at $700,000,000; but even such an array of figures is meaningless by itself. It is only by comparison that they make their proper impression. The largest product with which a comparison can be made is that of the corn crop. This is given as having for the year 1880 the value of $679,714,499, but this is admitted now to be an overestimate, the returns for the census year having been made, not from actual measurement, while bushels of ears were often reckoned for bushels of shelled corn.

The other principal productions of the country are given as follows:

Wheat	$474,291,850
Hay	371,811,084
Cotton	280,266,242
Rye	18,564,560
Oats	150,243,565

Barley	$30,090,742
Buckwheat	8,682,488
Potatoes	81,062,214
Tobacco	36,414,615
Gold	33,379,663
Silver	41,110,957
Coal, bituminous	52,427,868
Coal, anthracite	42,139,740
Iron ore	20,470,756
Copper	8,886,295
Lead and zinc	4,182,685
Other minerals and irregular products of coal	12,399,964
Total mineral products, precious and non-precious	218,385,452

It will be seen, therefore, that the value of the forest products is more than twice that of the crops of rye, oats, barley, buckwheat, potatoes, and tobacco taken together.

We are accustomed to think much of our mines of the precious metals. They certainly have received great attention. They have had large influence in determining the movement of population and even the settlement of our States. They have sensibly influenced the politics and legislation of the country. But the annual product of our forests is nearly ten times in value that of our mines of silver and gold. It is three times that of the silver and gold mines, together with all the mines of coal, iron, copper, lead, and zinc. It is more than ten times, also, the value of the wool crop. In estimating the value of forest products we might fairly reckon, also, that of the coal, which is simply the forest product of former ages stored up for present use. This would add another hundred millions to our estimate, making it $800,000,000.

Another way of getting a proper impression of the extent and value of our forest resources is by looking at some particular classes of products, and especially such as the mass of people are not likely to regard, or such as seem by themselves insignificant and quite unworthy of notice. Take, for instance, the manufacture of barrels and casks, which few are likely to take note of. Yet we find by the census returns that the value of wood used for cooperage purposes is $33,714,770. We may take, again, such a product as baskets. We have more than three hundred establishments engaged in the manufacture of these, with a product of $1,992,851 in value. But this represents only a small part of the manufacture of baskets. All over the country, in every town perhaps, baskets of some kind are made, of which we get no account. The making of them is a common domestic industry. On every cotton plantation the field hands make the baskets which are used in picking cotton. So also for other uses baskets are made by a great number of persons, and, while the use of necessary material may be small in each case, the aggregate amounts to millions of dollars in value.

The boot and shoe manufacture is known as one of our principal industries. But how few think of the demand made upon our forests as a condition of that industry. From returns made to inquiries by this Department we find that not fewer than 813,847 cords of bark were used in 1880 for tanning purposes, at an average cost of $6 a cord, or a total of $4,883,082. But these returns embrace only 780 of the 3,105 establishments in existence. The census reports the whole amount of bark consumed as 1,454,771 tons, or 2,909,542 cords, which would give the entire value of bark used as $17,457,252. It is proper also that we should remember that to obtain the bark necessitates the destruction of the trees, and allowing that an acre of forest may yield ten cords of bark, we have as the result 290,954 acres stripped of their trees annually for this purpose; and we know that in a majority of cases the trees

are left to decay where they are felled, and so are utterly wasted, while no means are taken to replace them.

Another incident of the boot and shoe manufacture is that of lasts. We have sixty-two establishments reported as engaged in the manufacture of these, with products valued at little less than $1,000,000. From Bangor, Me., alone we have reported 1,500,000 last-blocks produced in the year 1882. But, in addition to the reported products of this kind, it should be borne in mind that lasts are also made, a pair or a few pairs at a time, in thousands of places from which we have no report. Still another manufacture is brought to notice in this connection. Who but the cobbler himself thinks of the little shoe-pegs? Yet we have twenty-six establishments engaged in the manufacture of these seemingly insignificant articles. And as we are considering such small things we may notice that, in addition to factories already in operation, a company are just building a mill for the production of tooth-picks, in which 10,000 cords of wood will be consumed annually, or more than 30 cords a day, while a single factory converts from 3,000 to 5,000 feet of pine lumber every day into match splints, and another turns out daily 45 barrels or 500 gross of clothes-pins.

Take again the construction of boxes for packing various commodities and conveying them to the place of sale. Who except the makers and purchasers are likely to consider these? Yet, $7,674,921 worth of lumber is consumed in making them, employing 7,772 persons.

Another important use of the forests is that of furnishing the materials of our wagons and carriages. We have 412 factories producing these materials to the value of $10,114,352, while our carriage and wagon factories themselves number 3,841, with an annual production valued at $64,951,617. Iron and leather are, of course, considerable items in the construction of our vehicles, but wood constitutes a large portion. In the subordinate manufacture of children's carriages and sleds, we have 67 establishments engaged, using materials valued at nearly $1,000,000, and the product at nearly twice as much.

The turners and carvers of wood use annually $2,940,630 worth of material. The manufacture of toys and games of amusement consumes wood to the value of $595,833, and for the manufacture of the diminutive spools upon which we wind our thread, the birch forests are bought up by thousands of acres at a time. The boxes in which our cigars are packed, and which are thought of only for what they contain, consume cedar wood to the value of $1,389,700 annually.

When we consider thus these lesser industries, comparatively unnoticed and unknown, and find that the manufacture of such things as match-splints, for instance, consumes the product of the forests to the extent of $3,298,562 in value annually, we see that, however, unimportant any one may seem by itself, yet taken together they are worthy of regard, and are an important aid in arriving at a proper estimate of the value of the forests and their usefulness. We have here touched the subject at only a few points. There is scarcely a comfort or convenience of life with which the forests are not intimately connected. We depend upon them, to an important extent, for food, shelter, and clothing, the prime necessities of life. We should not have the precious metals, silver, and gold, or the useful, such as iron and copper, but for the forests, which afford us charcoal for the reduction of their ores. They would not be either precious or useful metals, if we had not the forests with which to make them such.

Our cars and ships are the products of the forests. The thousand tools of our various handicrafts, the machineries of our factories, the

conveniences of our warehouses, and the comforts and adornments of our dwellings are the product largely of the forests. Behind all the varied industries and conveniences of life stand the forests as their chief source and support.

CLIMATIC INFLUENCE OF FORESTS.

Thus far our attention has been turned to the direct pecuniary or economic value of the forests. But they have other, which, if less obvious, are no less important relations to our welfare. They have relations to climate and atmosphere and so are connected with our health and comfort, and thus, also, they have most important relations to the larger interests of agriculture, commerce, and manufactures. The forests are great reservoirs and distributors of moisture. The atmosphere within the forest is always more moist than that of the open country. Taken in connection with the fact that the forests are, to so large extent, situated upon elevated ground, upon the hills and mountains, it can hardly be doubted that they attract to themselves the clouds and condense their moisture, so that there is a greater rainfall upon the forest-clothed ground than upon that which is not covered with trees. And while the forests are thus made to abound with moisture, they tend by the exhalation of it from their immense leaf-surface to impart to the region adjacent to them the beneficial influence of that moisture, promoting a richer growth of the grasses and grains of the husbandman.

But whatever may be admitted or denied as to the increase of the rainfall, as occasioned by the presence of forests, no one of any observation, or who candidly considers the subject even for a moment, can deny that the forests have a direct influence, and a most important one, on the distribution of the rainfall. The accumulated leafage of the trees, falling from year to year, produces a soil of spongy texture. The rain, be it more or less, which falls upon this soil does not flow at once down the hill sides, as from a house roof, or as it would from hills bare of trees, but is held in suspense, so that it trickles away gradually into the brooks and rivulets and thence into the larger streams, or sinks into the deeper soil to reappear in springs in the distant meadows and pastures. The result is that the streams flow with a nearly equable supply of water from season to season. When, on the contrary, the forests are removed from the hills, the spongy surface soil itself is soon dried up by exposure to the sun and winds, and is washed away, and then the falling rains or melting snow, no longer having anything to detain them, rush down the slopes at once, filling the beds of the streams to overflow, causing floods and torrents, often doing great damage to property and frequently occasioning loss of life. So again, in the season of the year when the rainfall is comparatively scanty, there being no reservoir of stored-up water on the spongy slopes of the hills and mountains to make up for the deficiencies and send their steady streams into the water courses, the volume of the rivers is diminished and the supply of water is inadequate to the demand. The mill wheels can no longer drive the machinery in a thousand factories, and tens of thousands dependent upon them for bread stand idle or can use only half their capacity of labor, and the owners cannot secure the proper return for their large and costly investments.

So, also, the boats of commerce are impeded in their course. Goods cannot reach their destined markets at the expected time. Contracts are unfulfilled. Obligations are not met. The whole course of business is deranged, and vexation and loss, beyond measure almost, are occasioned. The husbandman also feels the effect in his stagnant or with-

ered crops. The springs fail him in the pastures and the cattle fail him in the field and in the stall. And all this derangement of life and disappointment of toil and expectation because the trees have not been left on the hill-sides to hold out their leafy hands to catch the rain drops for man, storing them at their feet and dispensing them seasonably as his needs demand.

While the forests have this intimate connection with the moisture of the atmosphere and the distribution of the rainfall, and so an important connection with the great interests of agriculture, commerce, and manufactures, by their very mechanical presence and physical bulk they serve as barriers against sweeping winds, which, by their mechanical violence, would prostrate the crops of the husbandman, or, by their chill or heated temperature, would wither or destroy them. They often make it possible to raise particular crops or to secure certain fruits in a locality where, without their friendly presence and aid, their growth would be casual or altogether impossible.

From the most careful estimates, based upon prolonged and scientific examinations, the conclusion has been reached that for the best interests of any country, unless under exceptional circumstances, from one-fourth to one-third of its surface should be preserved in a wooded or forest condition.

In whatever aspect, therefore, we contemplate the forests, they present themselves as an object of the first importance. No subject has a stronger claim upon the attention and care of the Government than this; none is more vital to the national welfare. Our forest interest is not only, as we have seen, by far our largest interest, considered in a pecuniary point of view, but many other great interests are dependent upon it. We cannot, therefore, cherish our woodlands with too much care. We cannot take too much pains for their preservation. But from the beginning of our history, almost, we have been treating them as though they were of little or no value. Our country, at the time of its first settlement by the whites, was abundantly wooded, but in the westward movement of its increasing population we have hewn our way through the forests, and, calling in the flames to supplement the work of the ax, have destroyed them to such an extent that there is in many portions of the country not only a deficiency in the supply of lumber, but we are experiencing grave inconveniences and losses of other kinds.

We have cut and burned the forests with reckless wastefulness. It would seem as though our great anxiety had been to get rid of them as soon as possible. We have consumed our patrimony with spendthrift prodigality. We have wasted and are yet wasting the richest heritage which nature ever bestowed on any people. The emblem on the seal of one of our States is composed of a wood-chopper with uplifted ax. It is emblematic of the spirit of the whole country. Never was a land more munificently supplied with timber adapted to the manifold uses of civilized and industrial life than was our own at the beginning of its settlement, in that magnificent belt of white pine which stretched from the Saint John to the Mississippi, almost without interruption. Now little of it remains, and at the present rate of consumption in a few years it will be practically extinguished. There are left to us the great pitch-pine forests of the South, the firs and redwood of the Pacific coast, with the hard-wood forests which are to be found to some extent throughout a large portion of the country. None of these, however, can take the place of the fast-disappearing white pine, but as that fails increasing resort is had to them of necessity. Already the lumbermen of the Northwest are busy in the long-leaved pineries of the Gulf region, and

those great forests are falling with alarming rapidity. On the Pacific slope the same is true. In the arid regions between the coast range and the Missouri reckless cutting and numerous forest fires are making the country more arid continually, and destroying the means of irrigation so essential there to all agricultural production. In Oregon and Washington Territory forest fires anticipate the ax of the lumberman. The mountains of that region are hidden from sight for weeks and months together by the dense smoke from burning forests. The navigation of the great rivers can be carried on often only in the day-time, and then only with occasional soundings, on account of the obscuring smoke, and the traveler may ride again and again for fifty miles continuously over the track of the destroying flames.

WHAT IS TO BE DONE?

In view of these facts and many more of like character which might be mentioned, we may well ask if something cannot be done to stay this process of destruction. Are we to repeat in our history that of so many of the nations of the Old World, and see large portions of the country converted into a desert because of the destruction of the forests, which were nature's guarantee of fertility and salubrity? Or shall we, warned by their history and enlightened by the facts even now made obvious, adopt measures, which, if they cannot at once restore that which is already lost, may check the destructive influences which are at work and set in operation agencies which will lessen the evil results which are threatening us?

Among the things to be done are obviously these:

First. The Government should manifest its recognition of the importance of the forests of the country to the general welfare, by properly caring for the forests which yet remain in its possession. The Government cannot interfere with or regulate the use or consumption of forests which belong to individuals, corporations, or the separate States. That must be left to the influence of increased and diffused knowledge and enlightened self-interest. But nothing seems clearer than that the Government should take care of its own property and use it for the general welfare. And to-day it has no property so valuable as its forests. Its mines, its forts, its ships, the coined money in its vaults, taken together, are hardly comparable with them. These might all be lost without essential or permanent injury to the nation, while the loss of the forests would threaten desolation and national decay and destruction. The former the Government guards with all its power. Why should it not protect the latter with equal care? France points with pride and gratitude to the time, more than two hundred years ago, when Colbert, the great minister of Louis XIV, aroused by the ill-management and waste of the woodlands, exclaimed "*France périra faute des bois!*"—the destruction of the forests is the destruction of France—and when that monarch promulgated the celebrated ordinance of 1669, and began a system of forest administration, which, with some interruptions, has continued to the present time. The Bureau of *Eaux et Forêts*, or Waters and Woods, is one of the most important bureaus of the French Government. So settled is the conviction as to the value of the forests, so assured their place as one of the great and permanent interests of the nation, that even during the late Franco-Prussian war, although a law of 1860, appropriating 1,000,000 francs annually for a special forestry work, had expired by its own limitation, the work was continued, with only a partial lessening of the expenditure, and made

a charge upon the ordinary budget. The budget for 1880 contains appropriations of more than 3,000,000 francs for the forest service of the year.

What has been said of France is but an illustration of the general sentiment and the course of legislation throughout the countries of Europe in regard to the forests. They are everywhere regarded, not only as one of the permanent sources of revenue, but as of vital importance to the general welfare. No interest is cherished with more careful solicitude. They are maintained by the best scientific management and guarded by all the authority of law.

The time has come for us to look upon the forests in a new light. The time has come for us to regard them, not as an obstruction in the way of agriculture, as has so often been the case, or a convenience, but as a great national treasure, to be cherished as such and made the most of. Our spendthrift treatment of them should be stopped and a more thrifty course adopted. We should take a lesson from the hard experience of other nations before we are compelled to pass through that experience ourselves.

The first duty is to ascertain what extent of forests we have and their condition. It admits of no question that some of our most valuable and extensive forest regions, those especially producing the white pine, are nearly denuded, while in many other cases the forests are thin and of comparatively little value.

It would seem, therefore, the dictate of simplest expediency that the timber lands still belonging to the Government should be withheld from sale, at least until a complete and accurate survey of them has been made, such as will show, not only their value measured by the present amount of timber on them, but their importance as connected with climate, the supply of streams, and as barriers against harmful winds. The time has gone by when we need to give away such lands, if indeed any lands, for the sake of securing their settlement, much less to offer a premium for any such purpose. The general welfare, not only for the present, but for long time to come, as affected by the forests, is of more account and deserves more attention on the part of the Government than the convenience or the gain of individual settlers.

At the same time more efficient measures should be taken by the Government to prevent depredations upon the public timber lands. The public should be made to understand that the Government attaches a value to its timber as well as to its land; that both alike are property, the taking of which, in an unauthorized manner, is not to be tolerated, but to be punished. The public should be made to understand that in some cases the Government values its land chiefly for the timber growing upon it, and which can be maintained upon it by proper care. In the mining regions of the West and the arid regions adjacent, the streams are all-important both for mining operations as well as for irrigation for the purposes of husbandry. If the forests are removed from the hill-sides and the sources of the streams, mining and agriculture alike will suffer. In many cases also if the forests are once removed they can never be restored, even with the utmost care.

The Government, therefore, should ascertain, by a careful examination with reference to this very object, what forests ought to be maintained as such, and secure them from injury and depredation. Provision should be made by law that no timber should be cut below a certain size, except so far as a proper thinning, in order to promote a better growth of remaining trees, should make the removal of smaller trees advantageous. This method of treating the public forests has recently

been adopted in Canada, and it has long been the system of management in Europe. It follows, almost as a matter of course, when once we regard the forests, not as something to be neglected, as of no account, but as property or something having positive value. The European Governments, acting in this way, at the same time conserve the public welfare, protect the great interests of agriculture and commerce, and secure an income to the public treasury far exceeding the expenses of management.

It may well be questioned also whether on the prairie and other treeless portions of the country the Government should not reserve one-fourth of the land at its disposal to be planted with forest trees, or make it a condition in the sale of all its lands, and necessary to complete the title to them, that a certain percentage of every tract disposed of shall be planted with trees and forever kept in the condition of forest.

The timber-culture act also should either be entirely repealed or more effectual means taken to insure compliance with its provisions and the accomplishment of the purpose for which it was enacted. That purpose was chiefly the good of the country at large, and only incidentally the benefit of the planter. But the act has been and is constantly taken advantage of by speculators and others as a means of getting title to the land without any care or purpose to secure a forest growth. Much of the planting done, under semblance of complying with the requirement of the act, is little better than no planting at all. There should be some system of inspection, at or near the time of planting, by which it might be officially known whether the planting is properly done, and whether proper subsequent care is given to the trees, instead of leaving a matter of so much importance in uncertainty and allowing a title to valuable land to be secured by the oath or affirmation of an interested party eight years after the planting is supposed to have taken place, and without any official inspection. It ought to be a condition of every entry of a claim under the timber-culture act that the portion of land devoted to timber is to be always devoted to timber, is to be maintained in a forest condition, or the whole claim reverts to the Government.

FOREST FIRES.

The subject of forest fires is one deserving the most attentive consideration. Property to the amount of hundreds of millions of dollars in value is thus annually consumed in our country. It is estimated by the most competent judges that the destruction of our forests by fires exceeds that resulting from the ax of the lumberman. Says Major Powell, in his Report on the Lands of the Arid Region of the United States:

> The protection of the forests of the entire arid region of the United States is reduced to one single problem—Can these forests be saved from fire? The writer has witnessed two fires in Colorado, each of which destroyed more timber than all that used by the citizens of that State from its settlement to the present day; and at least three in Utah, each of which has destroyed more timber than that taken by the people of the Territory since its occupation. Similar fires have been witnessed by other members of the surveying corps. Everywhere throughout the Rocky Mountain region the explorer away from the beaten paths of civilization meets with great areas of dead forests; pines with naked arms and charred trunks attesting to the former presence of this great destroyer. The younger forests are everywhere beset with fallen timber, attesting to the rigor of the flames, and in seasons of great drought the mountaineer sees the heavens filled with clounds of smoke.

Professor Hilgard bears similar testimony to the destructive influence of fires, especially in California, and any one who has read the accounts

published within the last few months of fires raging in all parts of the country, sweeping over thousands of acres at a time, threatening towns and cities in their destructive course, impeding the lines of travel and blotting out the light of the sun for days if not for weeks together, cannot but be sensible that we are suffering a great loss from this source. But the present and pecuniary loss is not the whole by any means. Where these forest fires rage, not only is there a consumption of valuable timber, utterly wasted, but the soil itself is burned and destroyed so that it will not support another growth of trees or any valuable crop until, after the lapse of many years—it may be a century—the soil is gradually restored.

The losses thus sustained, and greater threatening us in the future, warrant the most liberal expenditure of money and the most stringent legislation in the endeavor to lessen, if we cannot wholly prevent, this lamentable waste and injury.

ENCOURAGEMENT OF TREE-PLANTING.

At the same time we should do what we can to encourage the planting of trees in those portions of the country now destitute of them or where they are not sufficiently abundant. Much can be accomplished in this direction by spreading abroad information in regard to the value of trees when planted in masses, their influence upon climate and the amount of rainfall, and consequently upon the agricultural interests of the country, as well as upon the health of the people.

One of the most desirable things to be done for the welfare of the country is to disseminate everywhere information in regard to trees and their uses, so that the mass of the people shall come to regard them somewhat according to their real value, to look upon them, not as something to be got out of the way whenever personal interest or personal feeling may so dictate, but to be cherished as friends; not to be recklessly destroyed, but to be held in trust for future benefit and for those who are to come after us. The words of Baron Ferdinand Von Mueller deserve to be borne in mind as expressing the true view of this subject. He says:

> I regard the forest as an heritage given us by nature, not for spoil or to devastate, but to be wisely used, reverently honored, and carefully maintained. I regard the forests as a gift, intrusted to any of us only for transient care during a short space of time, to be surrendered to posterity again as an unimpaired property, with increased riches and augmented blessings, to pass as a sacred patrimony from generation to generation.

FORESTRY IN SCHOOLS.

In Sweden the value and uses of trees are taught in the public schools, and school districts are required to have a sufficient amount of ground connected with every school-house to allow of the planting and cultivation of flowering plants, shrubs, and trees by the pupils. As they complete their school course they are allowed to transplant what they have cultivated into their home grounds, while those who enter the school after them fill the vacant places by their own planting, and thus the succession is continued. It would be one of the best things for us if a similar course of instruction were established in our schools. It would be most heathful in all respects to the children while at school, and its after influence upon the country would be most beneficial.

FORESTRY EXPERIMENT STATIONS.

It would greatly aid in the dissemination of information in regard to trees and do much to encourage tree-planting if there were established in

different parts of the country forestry Experiment Stations, or test plantations. These stations should consist of several hundred acres of ground each. They should be, as to soil and situation, of the average character of the region in which they might be located. They should consist, in part, of trees already grown as forest, where the effects of pruning and thinning could be tested and any experiments tried which might show how existing forests may be improved. On other portions of the ground all experiments in regard to the various modes of planting and cultivating trees should be tried. The best methods of gathering and storing seeds should be ascertained. The effects of irrigation should be shown. The value of wood of different trees, for fuel or for use in the arts, should be ascertained. The climatic range of trees should be ascertained also by the cultivation of a great variety, not only of indigenous, but also of exotic trees. To make such experiment stations most useful, we might well have one in every State. The time will come, undoubtedly, when there will be one in every State. But now there should not only be one at the Capital, but others also in the eastern, northern, middle, southern, and western portions, and in that peculiar region, the Pacific.

FOREST SCHOOLS.

In connection with these experiment stations there should be Forest Schools, where all that relates to the history and science of tree growth should be taught in connection with the practical work of tree-planting and culture. To urge the establishment of such schools may seem to some preposterous and to others premature. It will seem preposterous only to those who are ignorant of what is involved in forest growth, who do not know that by proper methods of culture ground covered with trees may be made to yield twice or three times as much wood or timber as we now derive from an equal extent of woodland. It will seem premature only to those who fail to consider how rapidly our present forests are being consumed and how long it will take to get such schools in practical operation. To those who know the present situation of the country as to its forests, or who will give proper heed to the facts which are established beyond all controversy, it will appear that we cannot take measures too soon for the establishment of these schools of practical and scientific instruction. If it be asked why the Government should engage in this work, and why it should not be left to private enterprise, the answer is that the Government owns a large tract of forest now which its own interest demands it should protect and develop to the utmost.

The timber lands yet remaining in possession of the Government amount to 84,564,207 acres, or an area exceeding the whole of the New England and Middle States, with the District of Columbia. But the Government is interested also in the growth and maintenance of a proper amount of forests on lands which have become the property of States or individuals. It cannot be expected that private enterprise will establish schools of instruction in forestry. The time required to develop a forest from the sowing of the seed or the planting of the young trees until their maturity is so long that comparatively few persons will even undertake the planting of a forest, and life is regarded as so uncertain that hardly any would be disposed to establish by private means a school of instruction in forestry. The work of establishing such schools must devolve upon the Government or upon some body having a longer life than falls ordinarily to the lot of man. And why is not this one of the most appropriate works of the Government?

If it may purchase and distribute seeds for the benefit of agriculture; if it may carry on protracted experiments in regard to the production of sugar from beets or sorghum; if it may investigate the character of diseases that destroy the lives of cattle or of insects that are injurious to economic plants, why may it not institute experiments to test the respective values of trees, their method of growth, their adaptations to different soils and climates, and all that relates to the most successful culture of trees? If, as we have seen, the value of the products of the forests so far exceeds that of the mines and many of what are regarded as the staple crops of the country, and we are ready to expend money without stint in behalf of these, why should we not care for the forests with a like readiness and liberality?

There is hardly a European country that has not one or more forestry schools. In all Europe there are thirty-seven. Germany, with an area equal only to two of our States, Oregon and Colorado, has nine such schools. Austria has eight. Little Switzerland has one in connection with her polytechnic institution at Zurich, besides elementary schools in the several cantons. France has about 7,500,000 acres of forest belonging to the state or to communes, and about 15,000,000 acres belonging to private owners. The administration of forests is under the charge of the ministry of finance, with a director-general and two administrators, with a conservator of forests for each of the thirty-two departments, and a large corps of inspectors, sub-inspectors, and guards. France has also at Nancy one of the best forest schools in Europe.

The principle upon which the strict forest codes of most European countries are founded, and which leads naturally to the establishment of forest schools, is thus stated by Professor Macarel, a high authority, in his "*Cours de Droit Administratif*":

> The preservation of forests is one of the first interests of society, and consequently one of the first duties of government. It is not alone from the wealth which they offer that we may judge. Their existence is of itself of incalculable benefit, as well in the protection and feeding of the springs and rivers as in their prevention of the washing away of the soil from the mountains and in the beneficial influence which they exert upon the atmosphere.
>
> Large forests deaden and break the force of heavy winds that beat out the seeds and injure the growth of plants. They form reservoirs of moisture; they shelter the growth of the fields; and upon hill-sides, where the rain waters, checked in their descent by the thousand obstacles they present by their roots and by the trunks of trees, have time to filter into the soil, and only find their way by slow degrees to the rivers. They regulate, in a certain degree, the flow of the waters and the hygrometrical condition of the atmosphere, and their destruction accordingly increases the duration of droughts, and gives rise to the injuries of inundations which denude the face of the mountains.
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> Penetrated with these truths, legislators have in all ages made the preservation of forests an object of special solicitude.

In the exercise of their right of eminent domain the governments of Europe go beyond what is necessary or would be practicable in this country, not hesitating to control by law the management of private forests as well as those which belong to the state. So Professor Macarel says on this point:

> The general law of France is that owners are free to vary, within certain limits, the cultivation and working of their lands; but, as to woods and forests, the public interests demand that individuals shall not be free to clear them from the soil whenever they please. From hence it follows that the administration has a right to pronounce its prohibition against clearing whenever it is deemed that the public interests require that this be done.

The law of Switzerland lays down the same principle most distinctly.

In Sweden, more than two hundred and fifty years ago, private owners of forests were required to plant and protect from cattle two trees for each one cut.

Prussian Germany has 20,000,000 acres of forests, half of which belong to the state and incorporated bodies, and half to private persons. In the care and management of these—one-fourth only of the extent of our public timber lands—the state expends annually $7,500,000, and from them derives an income of $14,000,000. And while, in general, the private proprietors are allowed to manage their forests as they please, they are liable by law to have their rights or privileges restricted whenever the general good demands it, as, for instance, where the clearing of a forest growing on sandy soil would expose neighboring property to be injured by having this sandy soil carried upon it by the winds, or where the volume of a stream would be lessened or made irregular in its flow by the removal of a forest growing along its banks or upon its head springs.

Nothing is better established, therefore, by the concurrent usage and legislation of other nations, than that the forests of a country are properly a matter of national concern, something to be cared for and protected by governmental authority. As to this we have been very neglectful. We have neither estimated properly our own forests, as we have lived among them and been benefited by them, nor so read the history of other nations with respect to their forests as to profit by it. Great dangers and sufferings of extreme character have led most of the Eastern nations to adopt stringent laws for the regulation of their forests, as something upon which their very existence was dependent. Spain has gone down from her rank as the foremost power of Europe to her present inferior position as the result, in large part, of the wasteful consumption of her forests. Other countries adjacent to the Mediterranean have declined in population and power for the same reason. Fertile regions have become deserts, and valleys and plains that once waved with grain have been buried under avalanches of stone and gravel which have been shot from the mountain-sides because their barriers of forests have been removed. The Khanate of Bucharia, an example within our own time, challenges our attention. Within the memory of those now living this was among the most fertile regions of the Asiatic continent. As one says, it was—

When well wooded and watered, a terrestrial paradise; but within the last twenty-five years a mania of clearing has seized upon the inhabitants, and all the great forests have been cut away, while the little that remained was ravaged by fire during a civil war. The consequences were not long in following, and have transformed this country into a kind of arid desert. The water-courses are dried up, and the irrigating canals empty. The moving sands of the desert, being no longer restrained by barriers of forests, are every day gaining upon the land, and will finish by transforming it into a desert as desolate as the solitudes that separate it from Khiva.

Such instances might be abundantly adduced. Countries thus injured or wasted by the destruction of their forests will continue to decline, or must await the slow renovation of their forests as the consequence of a properly awakened attention to the subject.

If we are not already among the suffering nations it is only because of our extraordinary resources. But already our streams are running with a lessened and unsteady flow. Commerce, on such great arteries of communication as the Hudson and Ohio, is impeded both by floods and droughts, which are the direct result of removing the forests. The interests of agriculture are suffering from the like cause.

We cannot be too prompt nor too energetic in taking whatever measures promise to be most successful, whether in protecting what forests remain from unnecessary consumption or in securing the planting of forests to a proper extent where there are none, or where they are not sufficiently abundant for the general welfare of the country. Our existing forests, in a large portion of the country, are but the semblance

of forests. The valuable timber has already been removed, or they have grown up in such neglect that they will yield but a small percentage of what would grow with proper management on an equal area. With the rapid growth of the country and the increasing demand for the products of the forests our timber-lands will rapidly vanish from sight, and it will require all our care and all our energy to avoid great inconvenience and suffering on this account. The market price of lumber is already much advanced, and a further advance is certain. It is for the interest of the individual States to take earnest action in regard to this subject apart from what the General Government may do. They should establish local experiment stations, and should provide, in connection with their agricultural colleges or otherwise, for instruction in the theory and practice of forestry. Similar instruction should be secured in connection with the experiment stations which the General Government may establish. On this account it would be desirable to have these stations located in the vicinity of existing colleges or scientific schools, as a large part of the necessary instruction could thus be given by the professors already engaged, and only perhaps a single additional instructor would need to be provided for. But the most abundant provision of means and the most generous outlay of money will be a cheap expenditure in securing the great and lasting benefits which may thus be attained.

Respectfully submitted.

N. H. EGLESTON,
Chief of Forestry Division.

Hon. GEORGE B. LORING,
Commissioner of Agriculture.

THE MEAT QUESTION ANALYZED.

By DR. G. SPRAGUE, *Chicago, Ill.*

The use of meat as an article of food has grown to very formidable proportions within the last few decades. The flesh of our domesticated meat-producing animals has been so improved in quality, and their capacity for laying on flesh so enhanced by careful breeding with these ends in view, and the range given to the use of meats by improved and diversified cookery, that animal food has come from habit to be a pressing need to the human race; at the same time it takes the lead as an article of commerce.

But few realize the extent to which improvement has been made, either in the matter of quality or the great gain made in the relative weight of the more valuable as compared to the less desirable portions of the carcass. Nearly every one is aware of the great improvement made in some of our vegetables and fruits, amounting to a total change in structure, qualities, and taste—in fact, resulting in the production of edible articles of the very highest value which before the transformation were valueless; witness the potato and the peach. Now, it having been possible in the articles named, accepting or discarding, as we like, the Darwinian doctrine of progression in physical structure, no one can deny the pliability in the hands of the careful breeder of the flesh and frame of the domestic animals, the flesh of which is used as human food. We refer now to the three species in use for the purpose named, these, viz., cattle, sheep, and swine, forming the bulk in all countries where improvements have been made.

The origin of our meat-producing animals, or rather the transformation from the wild races of remote ages, has been a study with only a few. Certain persons have made investigations in pursuing studies in natural history, and a few others engaged in rearing improved farm stock have undertaken to clear up certain mysteries and place within easy grasp the many curious features discernible in the present. A few breeders of improved farm animals bred for their flesh recognize the plastic nature of the bodies of our cattle, sheep, and swine, while much the larger number pin their faith to certain vague traditions pointing to a very ancient origin for each of the prominent breeds beyond which, as they believe, the knowledge of man goeth not. A careful, unbiased study of the facts shows us that prior to the middle of the eighteenth century there was no intelligent effort to improve the domestic farm beast; hardly, in fact, so far back as the period mentioned. So in all the period intervening between the time of Bakewell and the eventful era when Abram is reported to have been rich in cattle, the beasts of the field were uncouth, exceedingly imperfect as meat producers, and changeable in form, size, and characteristics, according to the climate into which they drifted and the influence of food supply, a location upon low marshy districts where vegetation was abundant conducing to steady increase of size of frame with augmented coarseness, while arid plains and high lands on which the feed was scant in a very few years would give origin to a smaller class with refined bone, hair, and skin.

LIMITED USE OF MEAT BY THE ANCIENTS.

The flesh of the early ox was, compared to that of modern times, rarely used as food. He was a beast of burden, was ridden, and harnessed to the plow. He was revered and handled with gentleness. The length of furrow that he was allowed to travel was 120 paces, and it was required that he have a breathing spell at the end of the furrow. In the time of Abram his flesh was permitted to be eaten, though in certain cases the use of it was limited or altogether forbidden, as when he was employed in labor and when his numbers were few. The Hindoos were forbidden to shed his blood at all; the Egyptians were only permitted to do so at sacrifices, and other nations were compelled to equal abstinence. The Jews were permitted to use the flesh of cattle, but they were abstemious in the use of animal food; hence the restrictions thrown around them were not severe. Now, the tendency was, as will be readily seen—even if the ancients were a progressive people given to making improvements, which they were not—for their cattle to retain their primitive forms persistently, except where modified by locality, climate, or feed, as stated. Nothing points to their having entertained any thought of improvement, changing the outer contour by selections in coupling or breeding, with a view to implanting marbled flesh within the inner structure. We have no reason to be surprised on either of these points, because, as to the first, all the various descriptions of cattle, offshoots of the original stock, whatever that may have been, have, during all the ages since Abram's time, bred as they would—changed in form by climatic and food influences, and not rendered plastic by the hand of man. As to the second point, which involves fattening tendency and marbling of the flesh, we certainly cannot reflect upon the ancients, as, with all the remarkable and praiseworthy improvements made during Bakewell's time and since, no systematic effort has been made to get at the bottom of the question of meat structure.

SUPERSTITIONS OF THE EARLY DAYS.

While the desire for meat food prevailed with the ancients to a very limited degree, still, for their help in labor, for their milk, and as an article of barter, domestic animals were held in high esteem. To such an extent did this obtain that even in addition to the fact that they were objects of worship the portraits of the ox appeared upon the coins of those days. To destroy them wantonly was a public crime. Pliny tells us that a Roman citizen was condemned to exile because he killed his laboring ox to gratify the appetite of a capricious person. The Celtic nations of Europe seem to have possessed somewhat of the same sentiments, as we are told by historians (Low), and even up to a late period there were superstitious remembrances attached to the red cow, whose milk was believed to be a charm for certain ailments. This traditional sentiment points to the fact that a red cow was a rarity, the prevailing colors having been black, brown, fawn color, and a combination of these. A large number in later years were white.

CATTLE.—VARIATIONS IN SIZE.

At what period the changes in form and size of the meat-producing ox occurred we have no means of knowing. The Uri, described by Julius Cæsar, reported as prevailing in the Hercynian forests, were said to approach the elephant in size. Pliny refers to them as inhabitants of Scythia and Germany, along with the bison. Pliny speaks of the bison as an animal like a stag, brought from Africa. Salonius corroborates the statement of Pliny.

We are told that fossil skulls have been found in various parts of Europe resembling the domestic races of cattle, differing only from them in size. These bones indicate an animal three times as large as the modern races of cattle. The question very properly comes in here, whether or not the very large size to which some of our modern thoroughbreds and high-grades attain is not attributable to the possession of blood from the ancient stock referred to. The remains of the large cattle to which reference is made are found in the same strata with those of the elephant and other large animals which formerly inhabited Europe, proving that they lived in the same era. Shaw tells of an animal of the cattle kind found in various parts of India, north of Bengal, called the "amee," which far exceeded in size any of the cattle kind heretofore discovered. Its height was said to be as much as twelve feet. The horns, which were full two feet in length, were erect and semi-lunar—flattened, and annularly wrinkled, with smooth, round, approaching points. The amee is seldom seen within the European settlements, but a very young one was picked up alive in the Ganges many years ago which was as big as a large bullock, and weighed three-quarters of a ton. Some of the native princes were said to have kept them for parade under the name of fighting bullocks. As before stated, so far as history informs us definitely, the different breeds of cattle have differed widely in external appearance and size, according to climate and as food was abundant or scarce. A difference, however, which is esteemed remarkable, is that which divides them into two classes, viz., the *aurochs*, or ox without a hunch on his back, and the bison, or hunched ox. All the tame cattle without hunches have proceeded from *aurochs*, and all with hunches are the issue of the bison. History tells us that, beginning with the north of Europe, the few cattle found in Iceland are without horns, though otherwise vary little, if any, from those of more

favored localities. In size, it is stated, the rule applies in all countries that this depends upon the abundance or absence of feed.

The Dutch are reported in early accounts to have often brought cattle from Denmark, which grow and fatten prodigiously in their pastures, giving plenty of milk. The Danish cows are mentioned as longer in the body than the generality of cattle. The oxen and cows of Ukraine, where the pastures are excellent, were a good many years ago (the period not being given by historians) the largest in Europe, and similar in other respects to our cattle. The hunched oxen are stated to have been more like the domestic cattle of Europe in the color of the hair and figure of the horns. The handsomest were reported all white, like the cattle of Lombardy. Some were said to have no horns, others those much elevated, and still others that were so bent down that they were almost pendant. They are stated to have had soft hair, and the hunch on the back is said to have been made up of a fatty kind of flesh, very tender, and equal when cooked to the tongue of the ox. The excrescence on some of these animals weighed from forty to fifty pounds. Some specimens had prodigious horns. There was one in the French King's cabinet which was 3½ feet in length and 7 inches in diameter at the base. Many travelers affirm that they have seen them of a capacity sufficient to contain fifteen or twenty pints of water. On the contrary, all the northern countries of Africa and Asia and Europe, entirely comprehending even the adjacent islands to the Azores, are inhabited by oxen without a hunch, which derive their origin from the aurochs.

Every part of South America is inhabited by oxen without hunches, which the Spaniards and others have successively transported. Thus the wild and the tame ox, the European, the Asian, the American, and the African ox, the bonasus, the aurochs, the bison, and the zebu are, say historians, all animals of one and the same species, which, according to climate, food, and the different usages to which they have been subjected, have undergone all the variations mentioned.

Naturalists have not been able to settle the question as to whether or not the cattle, the fossilated remains of which were found, as before stated in this paper, in the alluvial deposits in various portions of Europe, were the parent stock from which our present races of domestic cattle originated, and the same, in fact, described by Julius Cæsar. The question is put in the following form, and it is argued that we can—

> By all the evidence which the question admits of, trace the existing races to the Uri, which long anterior to the historic era inhabited the forests of Germany, Gaul, Britain, and other countries. It is a question involving an entirely different series of considerations whether these Uri were themselves descended from an anterior race surpassing them in magnitude, and inhabiting the globe at the same time with other extinct species. While there is nothing that can directly support this hypothesis, there is nothing certainly founded on analogy that can enable us to invalidate it. The fossil Urus inhabited Europe, where a very different condition existed with regard to temperature, the supplies of vegetation, and the subsequent development of animal forms. Why should not the Urus under these conditions have been a far larger animal than he subsequently became?

The great ox of Lincolnshire fens exceeds in size the little ox of Barbary or the Highland hills, and we cannot consider it as incredible that an animal which inhabited Europe, where elephants found food and a climate congenial to their natures, should have greatly surpassed in magnitude the same species under the present conditions of the same countries.

Anthony Fitz Stephen, who wrote in the latter part of the reign of Henry II, describes the Uri as then abounding in the forests around London. John Leslie, who wrote late in the fifteenth century, states that

the wild ox, which he terms the *Bos sylvestris*, was found in the woods of Scotland; that it was of of a white color, had a thick mane like a lion's, and that it was then found only at Stirling, Cumbernauld, and Kincardine. Those at the noble park of Hamilton are still in existence, preserved with care. They have lost the thick manes ascribed to them by the early writers, and the females have become generally destitute of horns, but all their other characteristics show them to be the descendants of the ancient race.

CHANGES IN FORM BY CROSSING.

As proof the of readiness with which peculiarities of form may be overcome, we quote the fact that specimens of the larger as well as the smaller races of Hindoo cattle have been taken to England at various times, and being crossed with native cattle the hump of the Hindoo beast disappears with the first cross. This being the case, it is easy to see how plastic is the flesh and frame of our meat-producing animals, and how remarkable it is that during the centuries up to the middle of the seventeenth no effort that we can learn of was made to improve the model of the domestic races of cattle, rendering them better suited to yield flesh of high quality as an article of food for daily use.

THE IMPROVEMENTS OF THE EIGHTEENTH AND NINETEENTH CENTURIES.

Mr. Bakewell, of Dishley, was the first who undertook the improvement of cattle and sheep with system and intelligence. Mr. Bates has had to bear about all the blame that has attached to the early improvement of cattle. He was gruff and outspoken, and his dogmatic style and selfish ways were brought out quite plainly, while Mr. Bakewell was secretive and no doubt equally selfish, but not so self-asserting as Mr. Bates, hence escaped criticism. The modes of Mr. Bakewell have never come fully to light. He only trusted one man—a faithful old flock-master—with his plan of crossing. It was known of him that at one time he bought a black ram in market, but his purpose was not suspected at the time, and nothing was heard from the ram after passing into his hands. The very few who had knowledge of the purchase doubtless supposed as the ram was fat that he was bought for slaughter. A considerable time after the purchase—it might have been one year, it might have been two or three years—a visitor who was well received by Mr. Bakewell staid over night at his house, and was shown quite generally over the premises by his host. He observed, however, that there was one portion of the place that seemed to be purposely avoided by the proprietor. The visitor having his curiosity aroused got up very early the following morning, and upon gaining access to the place referred to there found the black ram carefully secluded from the observation of visitors. Feeling that he had infringed upon the rights of his host, the fact was not mentioned till, we think, after Mr. Bakewell's death. Now, the ram referred to was said to have been an unusually good feeder, and laid his flesh on rapidly. After Mr. Bakewell's death it is reported that black lambs were occasionally dropped from ewes (Leicesters) of his breeding, though none were ever seen during his lifetime. The inference, of course, is that they were destroyed, the white ones only being permitted to grow to maturity.

Regarding Mr. Bakewell, his improvements were made mainly in sheep-breeding, though to a degree upon the long-horned breed of cattle. We have Mr. Bates' statement that in 1782 his attention was first drawn to the importance of agricultural improvements by Mr. Wartell, of Great Britain, while on a visit to the southern part of the county of North-

umberland. Mr. Wartell was a man of superior information in his day. Mr. Bates always spoke of him as the first improver. He bred good cattle and furnished bulls of improved breeding to the farmers, buying their steers, which he fed upon his own farm.

Pedigree was everything with Mr. Wartell; a long line of the best ancestors was indispensble if one wished to breed to a certainty; not that he did not know that great judgment was necessary in putting the most proper males to the most suitable females.

This, Mr. Wartell said, was the only way to make a permanent improvement in any breed of stock, bearing in mind the purposes for which they were intended. During the Revolutionary war in this country, times in England were very much depressed, and so remained during the whole of the last quarter of the century. Mr. Wartell bred the bull known as Jolly's bull (337). It must have been about 1769 that Mr. Wartell sold this bull, then a calf, to the young man Jolly—then seventeen years old—for thirty guineas; but Jolly, thinking perhaps that one good bull was enough for the lifetime of one man, never bought another. So he is not credited with doing much towards making improvements. Not so, however, with the Collings, Bates, and others who made such permanent and decided improvements upon the cattle of their time that the impress of their best animals holds to this day. Notwithstanding the efforts that have been made to perfect the various breeds of meat-producing animals, a full understanding of the inner structure of the cattle beast has never been had.

Vague notions existed, amounting to a positive belief with some, that there was a difference in the meat of the prompt-fattening beast as compared to the coarser-framed, slow fatteners, but no efforts seem to have been made to get at a full understanding of the subject. If the breeders in Mr. Bates' time, and those who manifested a good deal of intelligence during the fourth of a century prior to his beginning as an improver of cattle, had gone to the bottom of the subject investigating the peculiarities of the cellular, muscular, and circulatory structures, very rapid strides could have been made from the start by intelligently associating the fattening tendencies and the quality of the meat with the structure of fiber and cell, breeding from such animals in preference which, through their near of kin, gave evidence of the possession of such interior structure as we are now learning is indispensable to insure rapid fattening and marbling of flesh. We have no knowledge of the subject being brought to public notice prior to the meeting of the American Short-horn Breeders' Association at Cincinnati in December, 1873. In an essay read by the writer, entitled "Short-horns, conformation, contour, quality," the following passage occurs:

While our efforts to appear well in the show ring and to possess certain favorite families are commendatory, we are too much led away by the surface of things. The demands of fashion in cattle are too much like the demands of fashion in dress; if the surface captivates by its splendor, no matter how much shoddy is beneath. Throughout the system, under the skin, between the muscles, and among the fibers of these, there is distributed what is called cellular tissue. As its name implies, this is made up of cells, and in these cells the accumulation of fat, whether it be much or little, is deposited. The extent to which this tissue is found varies very much in different animals. When abundant and associated with strong digestion, active absorbents, and a well-formed carcass, flesh is taken on very rapidly, and if with these conditions the skin be pliable and soft the animal will handle well if in fair flesh. Now the common notion is that all animals that handle mellow have highly-flavored, tender flesh. This is an erroneous idea, proved so every day on the butcher's block. Many Short-horns have well-marbled flesh, but in place of tests having been made in all herds as should have been done, by slaughtering off shorts from every animal in each herd—so far as practicable, testing the meat of old cows, when no longer useful, as an index to what she leaves in the herd—there is hardly a thought given to this, and we propagate for color and contour mainly.

Following the reading of the paper, a brief discussion sprang up as follows:

Mr. DOTY, of Illinois. There is one question I would like to ask the doctor. I would like to know how far the touch is an indication of the quality of the flesh. I would like to have the doctor explain himself fully on that point.

Dr. SPRAGUE. Mellowness under the touch is not an infallible indication of the interior flesh of the animal as to the fineness of the fiber or the marbling of this. It does indicate an abundance of cellular tissue under the skin. I have to repeat that the butcher's block is the only entirely certain test of the quality of flesh in an animal.

Mr. THRASHER, of Indiana. I have been taught to believe that touch is an indication of the character of an animal's flesh. That has been my education up to the present time. But now I want to ask the doctor a question. In what colored animals do these good eating qualities predominate? I wish the doctor would tell us that.

Dr. SPRAGUE. Common opinion among breeders is that the whites and roans have the finest flesh, and that has to a degree been my belief; but I say again that the butcher's block is the only safe and sure test of the eating qualities of an animal of any color.

Hon. Mr. CHRISTIE, of Canada. I am afraid that anything I may say in addition to what has been so well said by Dr. Sprague will add but little of value to the discussion. The doctor has gone at length into the discussion of the shape, appearance, flesh, handling, &c., of Short-horn cattle. I fully bear the doctor out as to whites and roans. I observe that there exists in this country what seems to me an unaccountable preference for red Short-horns. My experience during a period of thirty years in breeding Short-horns is that the best feeders and handlers, as well as the most tender-fleshed animals, are white; it was almost wholly the original Short-horn color. When red existed in the early Short-horns it was not a dense but a yellow red. I agree with Dr. Sprague in regard to handling. It has its use and proper value, but is no sure indication of the condition of the flesh. A papery hide is not desirable, as we all know. I have noticed that the best flesh rebounds under the touch, like India rubber. It yields to the pressure of the fingers, but in a moment resumes its smooth surface. In cases of that kind I have observed that the flesh was fine, marbled, and tender. I do not know that I can add anything to the essay of Dr. Sprague, but it seemed my duty, as well as the duty of all Short-horn breeders, to educate the public and remove the popular prejudice against light colors in Short-horns.

Dr. SPRAGUE. I would ask Mr. Christie if he has observed any difference in the quality of flesh after cooking, and what results, if any, he has arrived at in this way in regard to color?

Mr. CHRISTIE. There is a class of cattle deriving their qualities from the old Dutch cattle. They were tough, dark-fleshed cattle. They are a peculiar cattle in their conformation, and I have noticed that it was very difficult to breed their peculiarities out of a herd when once in it. They were a pointed-backed cattle, and were imported into New York. The Van Rensselaer cattle were of that character; they were darker colored, with hard, wiry touch. Their meat was dark and lacked the tenderness and fine marbled appearance noticed in the meat of good Short-horns, especially of the lighter colors.

The discussion was further participated in by Messrs. Lodowsky and Doty, of Illinois, and Mr. Thrasher, of Indiana, but every phase of the discussion went to show that the question of handling merely stood in the light of a tradition among breeders, no evidence appearing that the subject had been studied with a view of proving or disproving the connection between the touch of hide and hair and the quality of the meat within.

THE MEAT QUESTION ILLUSTRATED.

To further illustrate, we quote as follows from the remarks of the author of these papers at the annual meeting of the Iowa Breeders' Association, January, 1880, together with the inquiries and remarks which followed. On this occasion there was present quite an array of specimens of meat of all grades, mainly beef, with one specimen of the meat of the deer. These were taken to the meeting from a Chicago butcher's shop, where only high-grade steers are cut up, others being procured at Des Moines from low-grade carcasses, and from two thoroughbred cows that had gone barren and were fattened on corn. The remarks were begun touching upon the subject of handling by producing a large, smooth apple as an illustration, the statement being

made that no matter how mellow the apple was under the touch, the fruit-man would not give an opinion upon the appearance or quality of the interior meat until he had divided the apple with the knife; the declaration being made by the speaker, that, in the present state of our knowledge, the study of this subject having been greatly neglected, the breeder could come no nearer to telling the quality or appearance of the interior flesh of the ox or cow, prior to cutting the carcass up, than could the fruit-man in the case of the apple. The speaker said:

This illustration brings us directly to our subject, viz., the interior quality of the fatted meat-producing animal. No dry meat, that is, meat which is not marbled, the fat being well introduced among the fibers of the muscles, can be otherwise than dry when cooked, if dependence be placed upon the pieces of meat itself. It is true that certain ingredients which a dry meat lacks may be artificially supplied by adding butter, lard, or other grease, but no improvised addition of this or any other sort can take the place of the fatty matters and juices which nature supplied to the meat of the well-bred or well-marbled steer or cow.

In regard to the adipose matter which enters the cellular tissue, we have to say, that fat is fat the world over, whether it be made from corn, oats, barley, ground feed from the mill, oil-cake, grass, or other flesh-producing substances. The differences to be noted are merely these: in young animals the flesh is white, in old ones it is yellow. In the carnivora it has a strong smell, while in ruminating animals it is nearly odorless. Now, whether much or little fat finds its way between the muscles and among the fibers of these, depends mainly upon three things:

First, upon whether the food given be charged with fat elements. These are found quite plentiful in corn and oil-cake, and in varying degrees in all other feed; quite plentiful in clover, blue grass, and timothy, in some of the wild grasses, and in varying degrees in other sorts.

Secondly, the accumulation of fat among the muscles, and among the fibers of these, depends upon the vigor with which digestion is carried on, accompanied by a duly vigorous process of assimilation. Some animals have this digestive and assimilative power in a very high degree, while others have it very weak.

In the third place, after the digestive process is complete, the fat carried by the blood finds a lodgment in the cellular tissue, and obesity, a condition of extreme fatness, depends upon the presence of a large amount of cellular tissue, accompanied by the other conditions named above. The wild animals and the thoroughbred horse have comparatively little of this tissue, hence they do not easily get fat; especially those do not that are fleet of foot, for adipose matter among the muscles would detract greatly from the capacity for speed.

I show you here a sirloin cut from a deer. You will observe that there is no fat among the muscles, no "marbling." I next show you a sirloin from a common cow. This cow was well fattened—plenty of fat under skin and about the kidneys, but none among the muscles. The cut which I next show you is from a fat Devon cow, bred and fed by Mr. M. L. Devin, near Des Moines. You will observe that the characteristic flesh of the Devon is shown here—lean meat without the admixture of fat. The Devon is noted for strength and activity of muscle, but not for producing marbled flesh. Here we have a sirloin steak and a rib roast from a high-grade Short-horn. These cuts were procured from a butcher in Chicago, who states that he keeps only high-grade meat. For this kind he gets three or four cents a pound more than is asked for the meat from low-bred cattle, as the latter do not marble their flesh. You will observe that this steak and roast are marbled well throughout. The next piece of beef I show you is from a thorough bred Short-horn cow—a descendant of Dahlia, by Upstart. Dahlia was imported into Clarke County, Ohio, in 1854. The crosses since 1854 have all been good, hence the cow and her meat fairly represent the class to which she belongs. She was a show cow from her calfhood up. You observe that her meat is splendidly marbled. It was so throughout, and in such a carcass there is usually very little waste. Of these cuts which I now show you, foreshoulder, forerib, loin roasts, and sirloin steaks, two of the latter are from the thoroughbred cow Orphan Nell, a Gwynne cow. This cow, as also the one named above, became barren, for which reason they were fed up and sold to the butcher. The meat of Orphan Nell, you will observe, is unusually well marbled throughout, no part of the carcass being deficient in this quality. The meat of the two cows is now being used in this city, and we learn is giving excellent satisfaction, which, of course, such meat cannot fail to do.

After the remarks upon the specimens were closed, the opportunity was given for inquiries or remarks:

Mr. John D. Whitman. It seems to me that this subject opens up a new field for thought that certainly demands our attention. Is it within the scope of the breeder's art to breed and rear this high-class beef, by breeding with express reference to it?

Dr. Sprague. I answer that it is.

Mr. WHITMAN. To what extent does food go in effecting this result? In other words, can you take a Texan steer, or an Iowa scrub, and take them from the calf to the butcher's block at three years old, on precisely the same food, and produce the same results, the marbling of the beef in both or either case?

Dr. SPRAGUE. I answer that you cannot. I make the statement, with entire confidence in its correctness, that the presence of a large amount of cellular tissue among the muscles is peculiar only to animals noted for their easy fattening tendencies. This has an application to high-breed cattle, sheep, and swine, and not to low-bred animals of these breeds. The fat cells are a part of the anatomical structure, are bred in it and born with it as much as the nerves, the mucus linings, and the skin. If an animal, as instance the deer and the low-breed cattle beast, has a deficiency of cellular tissue and fat vesicles, no plan of feeding whatever can supply this deficiency.

Mr. GUINELL. Does Dr. Sprague hold that veal is ever marbled?

Dr. SPRAGUE. I have not procured a specimen of veal to show you. Would not expect veal to show marbling to any great extent. Yet, if from beasts of such breeding as marble their flesh when made fat, the young calf would have the rudiments of the cell structure. This would not develop to any considerable degree in the growing state of the calf, but continued feeding would cause it to show itself sooner or later. There is no escaping in the case of the offspring a faithful duplication of the structure that has bred into the system of the parents. This holds with the scrubs, generally with the thoroughbred; it is just as much a question of prepotency—power to propagate the type of the parents—as it is a question of prepotency in an animal that is able to get spotted calves when the presence of spots have long been a peculiarity in the ancestry.

President WELCH. I want to ask the doctor what he thinks about this marbling quality being uniformly connected with a delicate offal or small bone, or whether it is not exactly uniform in that respect. Do you expect a large-boned animal under any circumstances to have this marbling power?

Dr. SPRAGUE. I would not expect to find fat cells to any considerable extent mingled with the lean of an animal with a marked coarse frame and bone. The fine-boned beast is generally smooth, rotund in form, consequently presenting in quite a degree the characteristics of a feeder. Still, some scrub cattle are of this form and have the fine bone to the full limit of propriety as compared with the weight of the animal, and I have up to this time failed to find finely-marbled meat within the carcass of any low-bred beast. I do not say such a carcass will not be found. I have no difficulty in finding the carcasses of grades that have this marbling in a pronounced manner.

President WELCH. I will ask whether, in the light this subject has taken, a scrub steer can ever be properly fattened—whether, if you find him so that he will lay on fat on the outside of the muscles and around the kidneys, the edible portions of the steer will not remain as hard and leathery as ever they were?

Dr. SPRAGUE. Yes; the fat that the scrub lays on is merely an accumulation which nature lays away for future use. If a steer so fatted should be neglected, or be caught under a straw stack and live, as sometimes happens, he has a surplus laid up to feed on which would be gradually absorbed. High feeding, however, enriches the flesh of any animal, but this increased richness lies in the fibrine and the blood which remains within the flesh after the animal is bled, as no ordinary process of bleeding can withdraw all the blood from the blood vessels, especially the minute system of arteries and veins.

Professor KNAPP. Are there any outward reliable signs that you can go by in crossing an animal that will produce this marbled beef in their get?

Dr. SPRAGUE. There are no unvarying signs nor indications open to the eye, because you cannot look inside. You must see the meat from specimens of his progeny or class of kin to enable you to form a reasonably certain opinion.

Professor STALAER. I would ask if the indications of the highest degree of fattening qualities, as shown by the outward form of a ready fattener, is likely to be accompanied with marbled flesh?

Dr. SPRAGUE. Nature rarely makes any mistakes; she is usually very consistent. If she gives an animal strong digestive power, well-sprung ribs, large stomach, heart and lungs, with consequent vigorous circulating power to carry the blood to the remotest parts with vigor, then we may reasonably look for a good supply of cells into which the fat may go. But while it is reasonable to look for this, we cannot presume that the cells will be abundant, except under the skin and about the kidneys. While the beast so constituted may and will store up a good deal of tallow, still tallow is a cheap commodity, and in the locations named it does nothing towards marbling the flesh. Variations in the matter of distribution of the cellular tissue and fat vesicles do exist in animals of the same contour and breeding.

Professor KNAPP. The other question I wish to raise is this: With respect to the great advantage to be gained in point of price by increasing the cellular tissue, and through this the distribution of fat, larding the muscles, how far can that safely be

carried? Might it not be carried to such an extent as to become a disease to break down the animal?

Dr. SPRAGUE. It is a very difficult thing to keep a cow that is naturally disposed to lay on flesh without endangering her breeding qualities, if she be at all high fed. An animal in a growing condition is uninjured by being well fed, yet you must be careful how you push the feeding. It is not wise to keep an animal in thin condition. By so doing you check the development of the fat tissues; you contract the cells, the home of the fat, and prevent their development. It is a very nice thing to handle a cow as a breeder, for a series of years, if she is a rapid fattener, as there is constant danger, when not in milk, that she will get fat beyond the point of safety. But when you have succeeded in doing this, and the animal has advanced in life beyond the usual breeding age, you can fatten her, if she is in good health, very quickly.

Dr. Sprague closed the discussion by saying that if there were no further questions to ask he would merely add that what we particularly need to do is to follow up the get of bulls kept at the heads of herds as they go to the butcher's block, thoroughly scrutinizing the meat product, the inner part of the edible portions as the fruitman scrutinizes the inner portion of an apple, propagating as much as possible, all other things being equal, from those animals that plant within their progeny the peculiarities and high characteristics of flesh which these samples of meat have been brought in to illustrate and make plain.

MEAT—ITS STRUCTURE.

It is generally supposed that the lean portion of an animal, used for its flesh, is a conglomeration of lean thrown together indiscriminately. This is an erroneous idea. In place of this being the case the body takes its shape through the presence of what is termed a system of muscles. These are distributed with especial and exact reference to the motions of the various parts of the body.

There are about four hundred muscles in the human body, and something fewer in the cattle beast. These are of various shapes and lengths, according to the position occupied by each and the uses subserved. Thus, there are half a dozen short muscles distributed about the ball of the eye, their use being to change the position of the ball in the act of viewing objects. There are a dozen muscles in the hand, which control the motions of the hand and fingers. There are about ten in the thigh. These are placed around the thigh bone, and all the motions of this portion of the lower limb depend upon the contraction of one or more of these muscles. The muscles of the leg and arm are round or flat, according to the place occupied, and like all other muscles are made up of a union of thousands of fibers, each of these acting like a spiral spring, as it has a zigzag shape when contracted. This shape is seen in lean boiled beef, the boiling process contracting the fibers and making these divisible, each fiber being easily separable from those to which before the boiling it was firmly united. While the muscles of the arms and legs are round, or measurably so, those of the chest and abdomen are broad and wide-spread, extending over a great surface. Thus, in the human subject there is a broad, long muscle called the *oblique extermes abdominis*, which is situated immediately under the integuments of the abdomen. It is attached above to the lower ribs, spreads out upon the abdomen, is outside of other abdominal muscles, is attached to the center line of the abdomen as it descends, crosses over the center line, and has its lower point of attachment on the opposite side of the upper rim of the pelvic bones. Its mate from the opposite side crosses it at its lower part, interlaces with it, and at this lower part plays an important part in the human economy, not necessary to our present purpose to describe here. Now, in the cattle beast, no matter of what breed or nativity, whether the sacred ox of the ancients or the Texan steer, you come upon a a broad muscle

which answers to this one as you remove the hide. So of every other part of the body. The eye of the ox is moved to the right and the left by muscles within the socket similar to those which move the human eye. His thighs, loin, and fore arm have muscles also similar to our own, made up of fibers, and interspersed among these are arteries, veins, nerves, cellular tissue, and fat vesicles, these being massed together into what is known as muscle, the form and shape in one cattle beast being the form and shape in all. At any rate, the variations are rare and very slight. These fibers and vessels are covered, each muscle by itself, with a thin membrane, or sheath. Each muscle is lean in its middle half or two-thirds, and tendinous at its ends, these ends being attached to fixed and uniform places upon the bony frame. Motion is produced, as stated, by the contraction of the lean fibers or bellies of the muscles, accompanied be the relaxation of opposing muscles upon the same limb. The minute subdivision of a single fiber of lean meat, which division can only be made by thoroughly drying the meat, brings out the evidence under the microscope that each fiber is made up of a good many scores of minute fibers, blood-vessels, and nerves, each one less in diameter than the single strand which makes up one-third of a No. 70 sewing thread, less in size by one-third than a human hair. Yet, the microscope with which the examinations were made, using lens No. 2, the lenses descending in magnifying power from 1 to 6, shows a human hair to be about three-eighths of an inch in diameter, and each subdivided strand of the lean fiber to be about from four to five-sixteenths of an inch in diameter, the blood-vessels which accompany these fibers being of like size. Though these minute fibres are not larger than one-fourth of a No. 70 thread, the minute cell structures, which hold through plant formation also, are plainly discernible. In young animals the growth of muscles is rapid, especially in length. It is to this that young animals owe the disproportionate height as compared to thickness and height of carcass. The muscles so join each other, the cellular tissue around them being nicely adjusted to fill the interstices, that the surface-finish of young animals when well nourished is symmetrical and pleasing to the eye. This fact applies to children as well. On arrival at the age of maturity, in a varying degree with different individual animals, the outlines of the muscles become clearly defined, and except in such as are quite inclined to plumpness, owing to the presence of a liberal supply of adipose matter, the surface loses a portion of its symmetry, and as old age creeps on the change of surface is very marked; this is seen in old persons, the adipose matter which in earlier years gave the surface a smooth appearance having disappeared. In young animals, the flesh when cooked is pale and has less consistence and nutriment than the flesh of the mature beast. Even the color, flavor, and nutritive qualities of the broth are much below that of the adult animal, the flesh of the latter containing more fibrine, osmazone, and the coloring matter of the blood, and consequently more iron. The nutrient properties of the muscles diminish materially as old age advances, especially if advanced age is accompanied by loss of constitutional vigor. The muscular fiber becomes coriaceous, loses its contractibility, is torn with difficulty, and requires much more cooking than that of the young or middle-aged animal. The degree of contractile strength in the muscle of an animal is a fairly correct key to the quantity of nutriment it contains. To illustrate, the contractile force of the muscle in the fœtus is barely distinguishable, its force is added to at birth, increased from day to day in the young animal, until at mature age it may be

said to be at its height, diminishing as age advances until measurably lost at advanced age.

SPECIMENS EXAMINED.

The specimens examined under the microscope and also subjected to tests by cooking, were taken from the loin at the point of division of the fore from the hind quarters of the two and three years old Shorthorn grades, and from corresponding parts of the Hereford grades of like ages, these being animals slaughtered and dressed in competition at the Fat Stock Show in Chicago, 1880. Specimens from same part of carcass were procured at a butcher's shop on Adams street, where only high-grade steers are cut up, and of low grade from two South Division shops, as also from a wholesale establishment on West Jackson street. A careful examination in every state, from moisture to extreme dryness, running through a period of ten days, shows no discernible difference in color, structure of fiber, or the equable distribution of fat vesicles, and fat among the muscular fibers of the show steers. So, after thoroughly weighing and sifting every feature of the structure of fiber and fat in the two breeds, as represented in the high grades presented as specimens, we conclude that superiority must be determined by early maturity, pounds of gain upon a given amount of food, relative weight of offal, of best to poorest parts, and by the test of public taste, based on the exterior form and finish, as from outward appearance some prefer one form and others another. The specimens of high-grade steer beef procured on Adams street showed nearly all the qualities of high marbling of the exhibition steers; and there were no differences in color, fineness of fiber, distribution of fat vesicles, nor in flavor or odor when cooked, though there was some difference in the degree to which the fibers were filled with nutritive substance.

THE SCRUB MEAT.

But a comparison of the scrub meat with the high grade prompts us ever in the future to turn our backs upon and refuse to take on our plate a cut from the class referred to. The lean fibers from this class of carcasses are like rubber, and are held together by a glutinous substance and not by cellular tissue and fat vesicles filled with fat, and easily separated, as in the case of the high-bred steers. The specimen pieces of the scrub meat, and this held good of the six examined, began to curl as soon as the drying process commenced, and in three days the pieces were curled up at the edges and thoroughly dry; whereas the cuts from the high grades remained moist and juicy and lay flat upon the paper, though on hand three or four days before the others were procured. When dry, the cuts of the scrub meat had no flexibility, would break before they would bend, and when cooked were without fat juiciness or flavor, while the specimens from the high grades maintained all these qualities after having been exposed a full week to the air.

THE TEST BY COOKING.

Small pieces of the size of a twenty-five-cent piece, though thicker, were folded into clean, white letter-paper and placed in a position to be gradually cooked, the paper absorbing all the fat given off by each piece. The specimens were taken from the leanest portions of the loin cuts of the high-grade steers, an effort being made to leave no fat perceptible to the naked eye. The result was that in the cooking the cuts from the high-grade meat filled the paper to the extent of the size of

each cut and a little beyond with grease, while the paper containing the scrub meat showed scarcely a trace or mark from the cooking, there being neither fat nor juice in either specimen. The odor given off from the high-bred meat was agreeable and very manifest, while no odor could be detected from cooking the meat of the scrub steer or cow; at any rate none of the odor of good meat. Likewise, the taste of the one was savory and rich, and the fiber tender, while the other was as tasteless as a basswood chip, and the fibers were like the fibers of wood between the teeth. The results were uniform in all the samples of both grades of meat, no specimen of high-grade meat lacking in flavor, tenderness, or juiciness, while neither sample of the low-grade meat possessed either of these attributes of high quality. Some of the scrub meat was of the lowest grade—that sold by the wholesale butchers to packers and canners for export. One specimen was from an old bull, and in the cut taken from his loin we found the glutinous substance which in all the scrub specimens took the place, as stated, of fat and fat vesicles in the high-grade meat, organized almost into tendinous fiber in places, holding the fibers firmly together.

SO-CALLED EXCESSIVE FATNESS.

A fattening animal is green while the fat is only present in liberal quantity in the cellular tissue, under the skin, and about the kidneys; and ripe only when the fat has entered the fat cells among the fibers of the muscles, marbling the beef. Therefore, as the marbling process takes place late in fattening, because the fat cells are closely confined and pressed upon in the bodies of the muscles, it becomes necessary to fill the fat cells in all other portions of the carcass, that, being filled to their full capacity, further accumulations may be forced, as it were, to find lodgment in the deep-seated parts, viz., in the very center of the muscles themselves. If, in order to insure further marbling of the deep-seated lean parts, it becomes necessary first to load the fat receptacles beneath the skin and about the kidneys to their utmost capacity, then by all means do this, disposing of the accumulated tallow outside of the muscles for other than table use. The butcher is not compelled to sell clear tallow for table use, neither is the consumer obliged to buy it. If we can breed animals that will marble their flesh in the early process of fattening, then we shall be relieved of the necessity of making a fattening beast over fat, in order to insure reasonable marbling. Until this can be done give us the fat abundantly under the skin and about the kidneys, selling it as tallow for what tallow is worth.

It would be very proper and a step in advance to offer a prize on the beast, or rather to the man who should breed and raise the beast, capable of showing the highest specimen of marbling with the least accumulation of fat, merely as such, outside of and measurably away from the muscles. That some portions of the muscular system may—as is occasionally the case with the heart, which is a (hollow) muscle—be the seat of deposit of an unnatural amount of adipose matter, causing the muscle to become pale and the heart's motions feeble, is no proof that all fat presents evidence of degeneration. The blood in perfect health contains fatty elements which in its rounds are given off and taken in by the fat vesicles, these latter holding it in store. The blood also carries the material out of which finger-nails and hair are made, leaving this at the proper place to replenish waste; and it would be just as proper to charge the hair and the finger and toe nails with being a degeneration from muscular substance as to charge this to the usual accumulation of fat in the system of man or beast.

THE EFFECTS OF EXERCISE.

No one questions that exercise hardens the muscles. This is illus trated in the practice of training horses for speed contests and men for athletic sports. Exercise increases the development of muscular fiber, as illustrated in the blacksmith's right arm, at the expense of the cellular tissue and fat vesicles; the exercise, if considerable, retarding the accumulation of adipose matter between the muscles and among the fibers of these. This is the inevitable result of friction between the muscles, as also between the fibers between the muscles. Those muscles of the meat-producing animal which are most exercised, namely, those of the legs and hind quarters, afford the toughest meat in the whole body, except, perhaps, the neck. Hence, we find that the muscles which have, in the usual action of the body, very little motion, afford the best meat; and for the reason given above this is always more completely marbled than the active moving parts. It does not follow that a steer fattened in the pasture-lot will ordinarily exercise his muscles enough to materially affect the accumulation of fat. At any rate he will not do this if full fed, after having become tolerably full in flesh.

THE TOUCH AS A TEST OF QUALITY.

We acknowledge to having looked upon these meat tests with no little interest, in that we hoped to prove that the outward signs of a fine handler would point quite unerringly to the quality of the meat fiber. So we selected a steer having a soft, mossy coat and a mellow skin, with the other indications of a fine handler in a marked degree, upon which to apply the tests so long recognized and acted upon by breeders. This steer upon being cut up gave no evidences of any higher marbling than either of the others, no matter what their touch under the hand. Failing to find corroborative evidence in this regard, we applied the microscope with care, in the hope of discovering a muscular fiber susceptible of a more minute division than the fiber of other steers in the show that came under the butcher's hand. In this we may have been in a measure successful, as the minute filaments of the muscular fibers of the fine-handling steer appeared under a lens of high power to be a little finer than others, though the difference was not pronounced—was, in fact, slight—not manifest enough to base a distinction upon. This will be conceded when it is considered that the slight difference, if any existed, was only discernable through a very high magnifying power applied to a single filament, being the 100th division, at least, of a single minute muscular fiber. One object of this examination was to discover, if practicable, outward signs that would point with tolerable certainty to the inner structure, during the life of the animal, that we might be able to predict while the animal was upon its feet what its fiber would be upon the block, and the extent to which this would be marbled.

Nature is wonderfully consistent in all her works, and the distribution of muscle and fat is quite alike through all animals of high organization, including man himself. Hence it is quite fitting at this stage of the discussion to refer to the fact that the deer as well as many other animals have exceedingly soft coats and pliable skins, yet no marbling of flesh. These facts have their bearing, and point distinctly to the need of more lessons and closer study. We should think it doing violence to intimate that a steer of coarse outward texture and heavy bone would show flesh of equal quality with one possessed of a moderate bone and

general marks of fine texture upon the surface. But, as for any differences observable in the exterior structure of the steers shown at the late exhibition, appearing to indicate a finer flesh fiber or better degree of marbling, we think the evidences brought out through the tests upon the interior structure point not very distinctly to either beast. A careful examination of the minute filaments which make up the fibers of the grade-steer meat obtained at the Adams-street butcher shop brings to view no difference in these as to caliber, yet they are, like the scrub meat, more transparent, and show more of the tubular form than the filaments of the meat from the exhibition steers. This may be owing in part to a slight difference in structure, though we think mainly to the fact that every portion of the deep-seated parts of the show carcass were thoroughly filled with fat and rich meat juice—in other words, with fibrine, a rich semi-fluid substance which exists abundantly in the blood and tissues of well-fed men and cattle.

The meat of the grade steers of the butcher shop was not so thoroughly marbled as was that of the exhibition carcasses; but, governed by the best lights at our command, so high a marbled state could not be expected, in view of the less general accumulation of fat throughout the body, the system of feeding in the one case having been much more thorough than in the other. Appearances indicate that under similar treatment the butcher's meat would have been quite like the other. If this is so—and we have preserved all the specimens for future criticism—quite a point is gained, as it proves that in the high-grade steers now distributed throughout the country we have the elements, so far as is possible in our present state of advancement, for bringing to the block the best-known grades of domesticated flesh.

UPON WHAT FLAVOR DEPENDS.

As we have stated in referring to the examination of the meat specimens from the Fat Stock Show and from other sources, there was a marked difference in the flavor of the different grade of specimens, always depending upon the extent of the marbling and the degree to which the animal had been fed up. The flesh of thin animals may contain a fair quantity of what is known as "meat juices," through an incomplete drawing off of the blood. It is an error to suppose that the quality of the meat in a given case is enhanced by the carcass being very thoroughly drained of its blood. The blood is rich in fibrine and other nutritious elements, and if the blood be drawn very closely the flesh is too much bleached. This comes of drawing the minute arteries and veins which accompany the minute fibrils of the muscles described elsewhere in this paper. Now, there is no objection to having a reasonable amount of blood in the deep-seated portions of the muscles, and by doing this the flavor and richness of the flesh is greatly increased. As stated, this will improve the flesh of thin animals, but it will not supply that important ingredient upon which the meat depends for its flavor, viz., osmazone. This word is derived from the Greek, and signifies "smell" and "soup"—signifying that the rich meat odor of soup owes itself to the presence of osmazone.

One great advantage which high-bred marbled meat possesses over that of a lower grade comes through the possession of osmazone. It is to a degree the presence of this element which gives the rich flavor and odor referred to in another place, as being observed quite manifestly in the high-bred meat, while the low-grade specimens were remarkable for an entire absence of these qualities. A better understanding of these

points will result in the rejection of low-grade meats by consumers, and nothing could occur that would be nearly so effective as a move of this kind in driving out low-bred cattle from the market, thus compelling farmers to make improvements which they seem so slow to take up, no matter how great and manifest the advantages every month in the year. Regarding the flavor and odor referred to as osmazone, M. Tisserand calls this ingredient *matière extractive du bouillon.* The bouillon soups found in our restaurants are derived from the French, and to be in keeping with the name should possess the high flavor and odor of good beef, otherwise the term is a misnomer. Osmazone is regarded as an extractive matter of a peculiar nature contained in muscular flesh, and in the blood of animals. It has an agreeable smell and taste, and is found in bouillon of meat in the proportion of one part to seven of gelatine. It seems to have been provided for the purpose mainly of giving an agreeable flavor and odor to meat—qualities which it is impossible to impart in any known mode artificially.

Bakewell, at the time he came into possession of the estate of his father (1755), came also into possession of cattle with very coarse frame and general make-up, and, withal, indifferent fatteners. As previously stated, the meat of the ox had never been cultivated by a people who knew how to prize animal food. Bakewell, as is well known to all readers of agricultural literature, devoted much of his early efforts to improving the coarse, slow-fattening breed of sheep which came into his hands in connection with the Long-horns. All accounts agree that the use of mutton as food was a thing of very slow growth, sheep having been valued mainly for their wool. The skin, with the wool on, was used by the Gauls and the Britons as materials for outer covering. When cloth was made from wool of the sheep at an early day, it was formed by wetting the wool and then pressing it together in the form of felt. It was an important era when Minerva communicated to her Athenians the gifts of spinning and weaving.

The flesh of the sheep was used, but with that temperance which still distinguishes the people of the Eastern countries in the use of animal food. They understood the art of curdling the milk of goats and ewes; and cheese and butter, with fat and honey, formed the simple repasts of these early people, as of the Kurds and Arabs of the present day.

So it was with cattle and sheep that had come down, through the lapse of time, from the earlier races without improvement, that Bakewell, Wartell, the Collings, and others had to deal. But when we consider the progressive steps which animal life has taken, from the period in which the simpler forms are revealed in mineral depositions, these and other facts having led naturalists to advance the opinion that animal life was first introduced to our planet in its most simple forms, we have no reason to wonder, considering the ignorance of the people who owned and tended the herds and flocks up to the middle of the last century, that no improvement had been attempted, at least none worthy the name. We are told that one of the races of early cattle, the blood of which doubtless flows in the veins of our present domestic breeds, had hard, coarse flesh. We have no account anywhere that the flesh of any cattle beast, prior to a period not farther back than seventy years or so, was well fatted and marbled. We are of the opinion that but very few of the early Short-horns, say eighty to one hundred years ago, had marbled flesh, even to a meager degree. Hubback may have had marbled flesh to a limited extent, but a knowledge as to whether he had or had not, while it would cut an important figure in cattle literature, we will never possess. One of the evidences

we have that no early cattle—that is, prior to the improvement—had marbled flesh, is found in the fact that as a rule in our day no common cattle have it, and many grade cattle either have no indication of marbling or else have this quality so slight as not to be worthy of note. The really improved cattle—those whose carcasses show good quality when cut up—are very scarce, and the number of this kind that come to the slaughter, when compared to the inferior—those yielding low-grade flesh—is very small indeed. The following reference is made by Low to the character of the meat found to prevail in the Long-horns, as improved by Bakewell. He says of their flesh:

> It has never entirely lost that darkness of color distinctive of the unimproved race, and the fat is less mixed with the muscular parts than in any other kind of British cattle. The tendency of the fat to accumulate on the rump is so great as to produce a kind of deformity in the fattened animal. Yet, this character might not of itself be regarded as an imperfection, were it not indicative of the general tendency of the fatty tissue to remain separate from the muscular. The fat, too, retains the tinge distinctive of the early race, so that it became a familiar remark of the opponents of Mr. Bakewell that, breed as he might, he would not get rid of the black flesh and yellow fat of the Long-horns.

If we needed any further evidence than what is contained in the above to show the very crude ideas entertained regarding the real nature of the required improvement in the meat of the domestic cattle of that day, we find it in a degree in the following from the same author. With respect to milk-giving, Low says:

> The Bakewell's improved Long-horns were greatly inferior to the older Long-horns. The character of the beef and the deficiency in the females in the power of yielding milk are the most manifest defects of the breed. The really beneficial influence of the stock has been the crossing of the older and coarser kinds yet reared in different parts of the country. In this latter respect the Dishly Long-horns have been of great economical importance, but the breed itself in its state of purity is deficient in the really useful properties of a grazing stock.

Carefully considered, the above extracts will be found not to be in harmony, and present evidence of the truth of what we have heretofore stated in this paper regarding the want of an intelligent understanding on the part of the early breeders in the matter of breeding out defects of interior structure and breeding in the marbling tendency instead.

Again, Low says:

> Bakewell looked to the property of acquiring fatness as the essential one to be arrived at in breeding. He acquired for his beautiful stock this property in an eminent degree, but he acquired it in excess. The fat mixed less with the lean than even in the older race, spreading itself in a thick layer under the skin and even accumulating a cushion upon one portion of the body. * * * Having at much cost [observed a writer] raised a variety of cattle, the chief merit of which is to make fat, he has apparently laid his disciples and successors under the necessity of substituting another which shall make lean.

This quotation is given by Low to illustrate what he sets forth as Bakewell's great error, viz., the breeding for fat to such an extent as to reduce the amount of lean meat in the fatted beast. Now, a reference to the anatomical structure of the fatted cattle beast, as described in another part of this paper, will show that the carcass has a given number of muscles, made up of lean muscular fibers, and that no plan of breeding will reduce the number of these, nor is there any danger of reducing the caliber of the muscles while breeding to establish rotundity of form, which latter Bakewell aimed to do from the beginning. It is likewise a fact that breeding, as Bakewell did, to increase the rotundity of form and improve digestion and fattening tendency at the same time, no other result could possibly follow than a filling up of the tissues of the fibrils of the muscles with fibrine, even though

they may not have filled up with fat, owing to a deficiency of cell tissues as a lodgment for the latter.

The same writer tells us that Bakewell regarded size in his animals as secondary and subordinate to those he wished to communicate, and to have directed almost exclusive attention to beauty and utility of form and development of the properties of early maturity and facility of fattening. So, when we analyze these statements and give due weight to all others, traditional and otherwise, we can but deduce that the early improvers groped their way in the dark, having but avery faint idea of the importance of the movement then being made and the weight that these movements would have upon the cattle literature of the future. If they did not breed with close reference to the production of the high class of meat that is just now attracting attention, they cannot be very closely criticised, because since their time four-fifths of the eighteenth century, noted for its discoveries and progress, has passed, and the question of disparity between the quality and value of low and high grade meats is a blank leaf to most men. All history goes to show that the first marked improvement in the Short-horn line owed itself to the discovery and purchase by Mr. Wartell and Mr. R. Colling of the bull calf afterwards named Hubback. This was the calf of a cow belonging to a poor man, which he grazed in a public lawn. She was remarkable for her easy fattening tendency, which she imparted to her calf to such a degree that he was useful for a breeder only a short time, owing to becoming excessively fat. The cow also was secured by Mr. C. Colling, who, early discovering the great value of the bull calf referred to, purchased it from Mr. Wartell and his brother, Robert Colling. The cow, in Mr. Colling's good pastures, also became excessively fat and did not again breed. Hubback was bought in Darlington market in 1777, then a calf by the side of his dam, but she was bought as a milch cow. The buyer, on his way home with the cow and calf, sold the calf to a blacksmith. The blacksmith gave the calf to his son-in-law, from whose hands he went as above stated.

Mr. Stephenson—son of Mr. Stephenson, of Kelton—described the grandam of Hubback as being from a tribe that his father had bred for 40 years. She was a small cow, exceedingly neat and stylish, with long, straight quarters, and was a great milker. Not realizing the importance to be attached in after years to the breeding of Hubback, no effort was made to trace the peculiarities of the origin and breeding of the animal with any such minuteness as should have been done. It is said to have been the opinion of many intelligent cattle-men, after Hubback's time, that had it not been for the progeny left by him the old Short-horn breed of cattle could not have been kept up. This was no doubt an extravagant statement, though there is no doubt the results which followed his use as a sire improved the Short-horn breeds very greatly as meat-producers, while at the same time the minds of breeders became suddenly educated up to the idea that rapid fattening, combined with symmetry, were of much more importance than mere size. Whether or not it was Hubback that mainly planted the cellular tissue among the muscles of his get, laying the foundation for marbling, we can never know. Certain it was that the description of cattle prevailing before his time could not, judging by the best lights at our command, have possessed other than the slightest tendency towards marbling the flesh.

We will close this paper with a review of the question of quality, as brought out by examinations made upon fatted steers before and after being slaughtered at the Union Yards, Chicago, and at the Fat Stock Show of 1881.

THE QUESTION OF TOUCH—1881—TESTS.

As stated, the remainder of this paper will be devoted mainly in the endeavor to show whether or not there is any connection between the outer touch—in other words, the "handling"—and the inner quality of the flesh of a fatted beast. Now, it is proper to refer here to the views entertained by the generality of breeders regarding "quality." The condition of surface generally accepted as coming under this term has never been so agreed upon among breeders as to assume tangible shape, becoming a thing that all men, understanding it alike, could learn. Some have believed the mellow touch to be a tendency merely to lay on flesh, or rather fat, without any regard to where the accumulating fat would be found upon dividing the carcass. The idea has been, merely, that the fine-handling beast would fatten kindly and gain in weight more rapidly than a coarse handler. Others have gone farther than this, accrediting the mellow handler with having a finer quality of lean flesh; that is, that the fibers would be less in size and the meat more tender than that from the coarse-handling beast. Still others go a step farther, and, while believing all that is stated above, add this item, viz., that the flesh of the fine handler is of a delicate, light-red color, hence correspondingly delicate in flavor. There are yet a few others who add to all these beliefs that the fine handler will always show well-marbled meat when made fat. Now, these beliefs are largely traditional. The early breeders, those who flourished during the latter part of the seventeenth and early part of the eighteenth centuries, dwelt very learnedly upon "handling." Their views, however, seem to have been very crude, and were not placed upon record in such a way as to impart knowledge of the subject to those who followed them. Neither did they take sufficient shape to form a nucleus around which in after years breeders could build a substantial structure. If any proof is required to show that the views were crude, having no complete foundation to stand on, we have proof in the fact that no progress has been made during the past one hundred years to render more intelligible the subject of "quality" as indicated by the touch. The whole subject to-day rests upon tradition fully as much as it did in 1785, in which year, as near as we can determine by the dates given, we find the most explicit reference to "handling" to be found in any early account. Bell refers to the subject, and we condense from him:

From this time a new era began in the breeding of Short-horns, and *quality* [italicized by Bell], which had long been neglected, again became properly esteemed as against mere size as the criterion of merit.

Again, on the same page, he says:

No man ever had better fingers than Mr. C. Colling—never had I to differ from him in opinion but once, though we often compared notes and always till this instance did we agree. Mr. Colling was very confident he was right and I was wrong. The animals we differed about both belonged to Mr. R. Colling; the one was Styford, and the othe. was what was called the grey bull. After a long discussion on handling, I asked Mrr C. Colling to go and re-examine both animals, and then say if he continued still of the same opinion. He did so, and acknowledged his error, saying, "The grey bull has precisely the handling Hubback had, and better than any other, except the cow you bought of me yesterday, and her handling I consider the best, and all her predecessors have had the same handling." Mr. C. Colling, says Bell, always showed the Duchess family as the model of good handling. Then I asked Mr. Colling the breeding of the two animals referred to, and he answered, Styford was by Favorite, and the grey bull by the white bull. The white bull's dam was by Hubback.

It was claimed that the Kyloe cross used by C. Colling added greatly to the thickness and hardness of the skin and to the coarseness of the

hair. However, Mr. Thornton, through his circular for 1869, states that such animals as possessed the "alloy were increased in size, rotundity, and heavy flesh."

The highest-priced cows at Mr. Colling's sale were those in the highest condition, and they were mostly of the alloy blood.

Mr. Carr, in speaking of a cow of the alloy blood that had distinguished herself at shows and bred some prize cattle, says:

The Isabellas had all the great capacity for rapidly acquiring ripe condition on pasture. * * * As an illustration of the fallaciousness of the usual mode of judging cattle by the softness of their flesh, it may be worthy of mention that at one of the Yorkshire agricultural meetings a grass-fed heifer, a daughter of Isabella by Ambo, was shown and rejected as being too hard-fleshed. Not breeding, she was slaughtered at York for Christmas beef. Her two successful rivals also failing to breed were slaughtered, and the prize for the best carcass of beef was awarded to Mr. Booth's heifer over her rivals.

Nor is this case without many a parallel in the history of royal shows. From the cows referred to by Mr. Thornton, having rotund, thick bodies, being quick fatteners and carrying thick flesh, the natural inference would be that they had the quality of marbling their flesh, hence capable of making the highest class of meat, at least the highest class at that day, notwithstanding animals with these excellencies were beaten by inferior specimens in the show ring on the single quality of feeling better under the touch, while it is nowhere made to appear that the judges knew fully how much or how little the touch indicated. Bell says, page 200:

I fear I have exhausted the patience of my readers with opinions on handling and quality, and also that it is not loose fat.

What meaning can be made out of this sentence and what impression does it convey except that the whole subject was a confused mess in the minds of the early breeders, as it has to too great an extent so continued to the present day. We quote the following also from Bell's history, as further evidence that the views regarding "handling" were the outgrowth, largely, of a fancy for a beast whose surface felt soft under the hand:

We all know how pleasant it is to pass the hand over soft fur. In a recent conversation with a breeder on this subject he remarked, "Well, at any rate, you know for the mere fancy of it we prefer to have cattle that feel nice under the hand."

Bell says, again:

What could Charles Colling mean when, on his retirement, he said, "If I had my eye-sight and the use of my fingers I should not despair of another herd."

Bates was an enthusiast on the subject of "handling." In fact it amounted in his case to a monomania. Bell (who had been a tenant of Mr. Bates) wrote his book mainly for the purpose of placing Mr. Bates and the families of cattle he bred in their true light before the public, according to his view. Forty pages of highly-wrought eulogies upon the value of fine handling, as indicating anything regarding the quality of the interior flesh, cuts no figure before one such test upon the butcher's block as is given above in the case of the Booth heifer, rejected on account of being a coarse handler, then beating, upon being cut up, two others receiving awards over her on account of their fine touch. As an offset, we have no records showing that beef animals won on account of its being demonstrated that they possessed marbled, high-class flesh in connection with a mellow touch. Low, in his history of Short-horns, merely says (page 387), "The skin is soft to the touch." He makes no

reference to there being any connection between the handling and the quality of the flesh.

It has been charged, though very improperly, that many Bates cattle were flabby under the touch. Now, flabbiness very often, and we mya say somewhat generally, depends upon a liberal amount of cellular tissue under the skin partially filled with adipose matter, this partial filling seeming to produce what is called a blubbery feel under the hand. This blubbery feel denotes, in some animals, a want of ripeness and gives place to outer flesh upon the feeding process being continued for a sufficient time. But while this happens in some cases, it does not happen in all, as some animals retain this flabby feel though fatted to repletion and kept fat for a twelvemonth. We have this illustrated in cattle of Booth, Cruikshank, and Hereford blood, as often as in Bates.

It is well known that tenderness and juiciness of meat depends largely upon the rapidity with which the fattening mass is carried on. Thus, if an animal be reduced to a low state of flesh and then fattened quickly no one need be told that the flesh will be tender and juicy, no matter whether the animal be steer, cow, shoat, sheep, or fowl, and if a cattle beast, the meat so fed up will be tender and juicy, whether the animal while living handled well or not. The beast which marbles its flesh will yield a finer grade of meat under this rapid-feeding process than the one which shows no marbling, for the simple reason that marbling uniformly shows high quality.

EXAMINATIONS AT UNION STOCK-YARDS.

On the 25th of October, 1881, we carefully examined a car-load of steers about eighteen months old, three-fourths of the car-load being the get of a thoroughbred Holstein bull, and the remaining fourth the get of a Short-horn sire, the dams of all being high-grade Short-horn cows. These steers were bred and fed by Mr. James Crain, of Ontario Township, Knox County, Illinois, and were sold to Wolf & Pfealzer, butchers at the yards, at a good figure. We had, through correspondence with Holstein breeders, endeavored to procure specimens of meat from thoroughbred or high-grade Holstein, such as had been fully fattened, but failed to learn of any such that were to be slaughtered. Hence it was quite opportune that we came upon this lot at the yards. The cross of the Holstein bull upon another breed is said, in Mr. Crain's hands, to result in black calves, no matter what the color of the dams, there being scarcely a shadow of white, except in rare instances. These steers, at any rate, were pretty much entirely black, only having slight show of white under the belly. The cross of the Holstein bull, so far as the exterior form is concerned, resulted in marked smoothness of all the parts, and the throwing in of new blood resulted, as it generally will, in infusing new vigor into the offspring.

We selected three steers of this cross, and one of the four by the Short-horn bull, carefully examining and making a record of the handling before they were slaughtered. Two of the three half Holsteins were exceedingly fine under the touch, having skin of medium thickness and decided mellowness, and hair of good length and of fine quality. The third black steer was not so fine a model as the others, nor was he fine under the touch. The Short-horn steer was a fine handler as regarded both hide and hair. These four steers were from cows of about equal depth in blood. Now, the remarkable feature of the cross Holstein and Short-horn grade remains to be told. The cross, while crowned with ample success, so far as size and symmetry were concerned—the black

steers being finely modeled, every one of them, and quite alike—resulted in wiping out the tendency to marble the flesh, there being no evidence of cellular tissue or adipose matter among the muscular parts, while the flesh of the steer by the Short-horn bull was marbled to the highest degree. We state the fact without comment, and shall look to future opportunities of like kind with interest.

RESULTS AT THE FAT-STOCK SHOW OF 1881.

We have given elsewhere in this article the results of the very careful examinations made at the Fat Stock Show of 1880 as to the exterior quality of the animals entered for slaughter, these examinations having been made upon the living animals, and again upon their flesh when cut up. The evidences obtained show that the interior flesh in every feature that goes to make up the highest grade of meat was quite alike, in all the high-bred animals slaughtered, regardless of the feel of the outer surface under the hand. This uniformity in the character of the meat held good, as to its color, fineness of fiber, and the degree of marbling. The flesh of all the high-bred cattle, whether Short-horn or Hereford, was marbled in every part, even throughout the neck meat.

The results of examinations made at the recent show are not in any respect different from those of last year, but are strongly confirmatory in every particular. The hardest handler of any steer slaughtered at the show was the Ayrshire steer "Jack," fed at the College farm at Champaign, Ill., and entered by the officers of that institution. Yet, when cut up on the block his flesh was found to be well marbled, nearly equal to the flesh of a high-grade Short-horn or Hereford. This steer was bred by Mr. Patterson, of Rock Falls, Ill. Now, it may seem strange to many that an Ayrshire, the breed being bred for milk rather than flesh, should show a marbled condition, thereby presenting meat apparently equal in this high attribute to the best fattening breeds. While we had no evidence that the Ayrshire steer had Short-horn blood in him, through any recent cross, this being quite possible as the Ayrshires are not kept pure in all hands, yet it is well known that almost, if not quite, within the memory of men now living the Ayrshire breed was puny and in every way inferior, not being more than half their present size and weight. And furthermore, that bulls were taken from among the Teeswater breed and used upon the Ayrshires. During the past thirty years the writer has personally known more or less of the breed, and it has been noticeable that many of the cows and bulls were inclined to the roan color, and many likewise were quite like the Short-horn in form, especially the dairy class of the latter breed. It is a question of no little importance, to be determined by future examinations, as to how generally the Ayrshire will, when fatted and slaughtered, show marbled flesh. The fibrils of the lean portion of the Ayrshire steer were quite similar in caliber to the fibrils of the meat of specimens from other breeds, from those shown last year, as well as from the recent show. Now, we ask that it be borne in mind that there can be scarcely a shade of room for question on this point, for no meat can be called coarse when the muscles are made up of fibrils not larger than a human hair, if as large. These, when magnified by a powerful instrument until as large as a wheat straw, under the eye, show a corresponding structure one with another. We think all will be ready to concede that, as to the question of fineness of fiber, this test under the microscope cuts off any opportunity of charging that the flesh fiber of either high or low bred cattle is coarse. Then, again, as to color of the lean flesh. Many, as is

stated in another place, imagine that a beast which handles fine will show flesh of a delicate pink color, and such as handle coarse will show dark-colored meat. Now, the color of the lean flesh depends upon the presence of blood, and blood owes its color to the presence of iron. So we think it may be stated that the color in the flesh of a dead animal depends largely, if not entirely, upon whether the carcass has been thoroughly or only partially drained of its blood. The fibers of muscles are without redness, where macerated for a time in water, this process reremoving the blood, thereby leaving no coloring matter. Now, the blood of a low-bred beast in color is like that of a thoroughbred, though the flesh is quite different. We have shown why this is so—not because of having a finer meat fiber or less coloring matter in this, but because of having a different anatomical structure.

Next to the Ayrshire steer in point of hardness under the touch comes the grade Hereford steer "Bailey," under two years old, owned and entered by Mr. Burleigh, of Mechanicsville, Iowa. This beast was thick in hide and coarse in hair, yet upon being cut up his flesh was found to be well marbled throughout equally with the fine-handling steer slaughtered at the same time. The minute fibrils of his muscles, like those of the coarse-handling Ayrshire steer, were of equal fineness, as shown by the microscope, with other steers entered for slaughter, including the very mellow-handler "Quidsit," entered by Mr. Nelson, of Canton, Ill. The very finely-marbled steer "Broad-horns," entered by Mr. Culbertson, of Chicago, that gentleman considered one of the coarsest under the touch that he had on his farm.

Breeders who have had any considerable experience will doubtless be able to call to mind individual animals in their herds that were coarse under the touch, yet of good form for laying on flesh, being well-ribbed, and in other ways well formed for rapid fattening; on the other hand they will be at no loss in calling to mind animals that are good handlers, but at the same time not having such organization as to enable them to fatten promptly. We have often been on committees where otherwise superlative animals have been beaten in the ring simply because they were not equal in "the touch" to others in the class, though in other respects vastly their superiors. We call to mind a stately cow shown at a State fair at Keokuk, Iowa, some years since, she being a model Short-horn as a feeder, yet was beaten on account of having a hard, thick hide, and rather coarse hair. She had competitors that were fine under the touch, but were not nearly her equals in other points.

The object of this paper has been to open a way for the better understanding of the meat question, by calling attention to the innermost facts, that through an observance of these before and after slaughtering, breeders and farmers, to whom the public look for their meat supplies, may improve this product, that all who have occasion to go to the butcher's stall, whether in city or town, may always find cuts of the better class instead of dry, insipid fiber now regularly found in the average shop.

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